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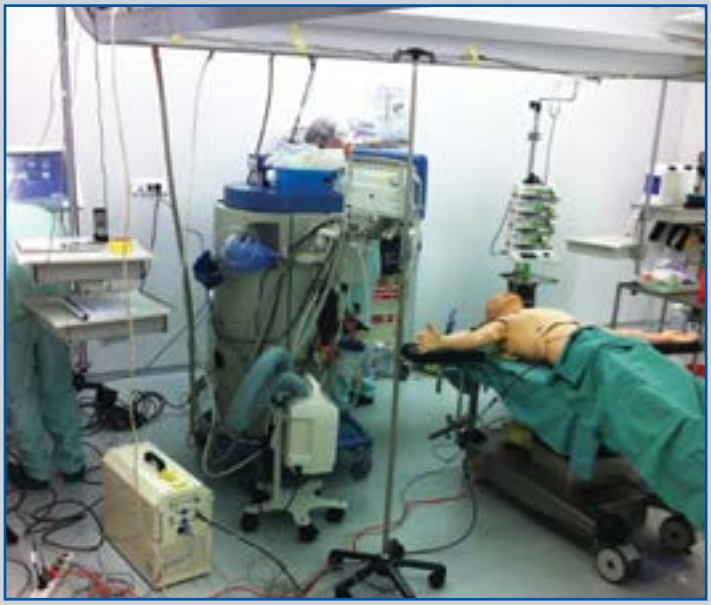

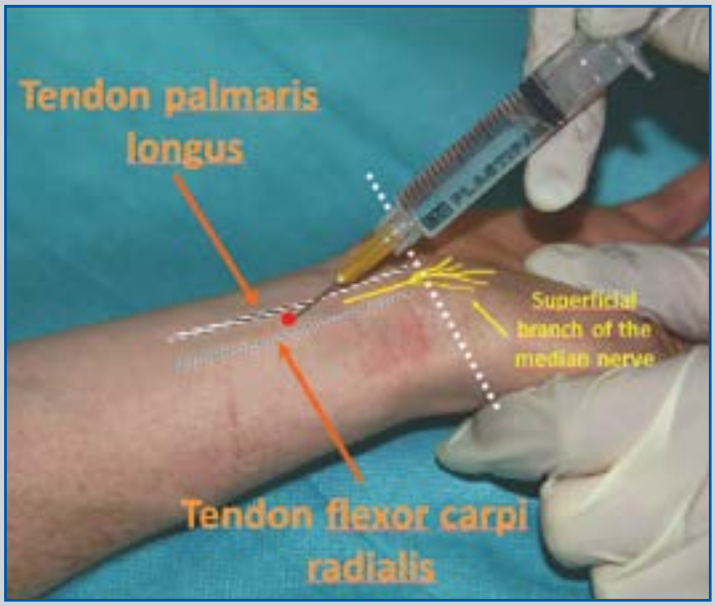

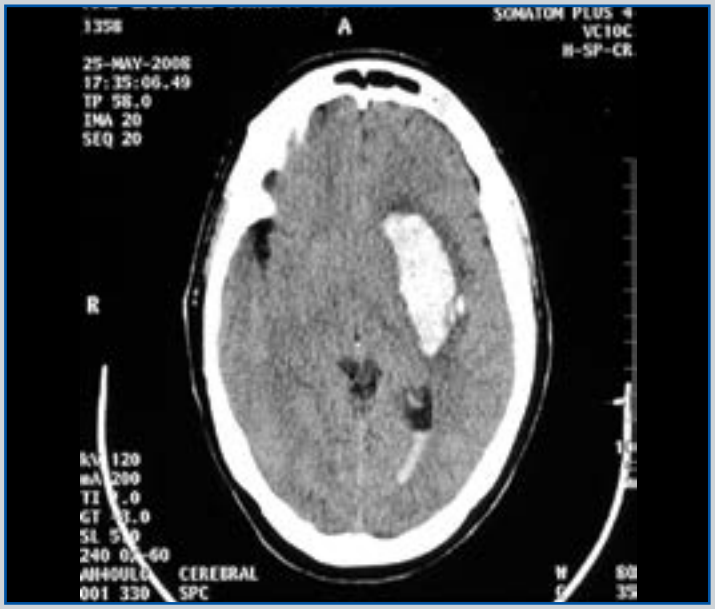

WELCOME TO THE VIITH MEMC

IRODAT: THE INTERNATIONAL REGISTRY IN ORGAN DONATION AND TRANSPLANTATION.

LOCAL AND REGIONAL ANESTHESIA IN THE EMERGENCY ROOM: HAND BLOCK AT THE WRIST.

MASSIVE BURN CASUALTIES IN SWITZERLAND: THE BURN ALARM PLAN

IN-SITU SIMULATION: A DIFFERENT APPROACH TO PATIENT SAFETY THROUGH IMMERSIVE TRAINING.

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TESTEZ VOS CONNAISSANCES EN TOXICOLOGIE: INTOXICATION PAR LES BÊTABLOQUANTS

112 CALLS: REALLY UNCONSCIOUS? BEST POSTER PRESENTATION AT THE 2D GNEM

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When there is a will,
there is a way ..

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Med Emergency, MJEM
New look, same mission, vision and value

Since its creation in 2009 Med Emergency MJEM adopted as a mission to be a platform of scientific and cultural exchange between the Arab Mediterranean countries and the rest of the world. Emergency medicine is certainly a scientific and medical discipline but its exercise is subject to traditions and to the culture of every region. Edited in the Levant with a global reach, the specificity of Med Emergency, MJEM resides in its rich content that is not limited to one category of articles to satisfy a readership that wants to know everything about our discipline but is rather filling a void in our region. We publish original research articles that remain for us the basis but also continuous formation articles, clinical cases, and experiences coming from various parts of the world thus giving the publication its value in daily practice.

Our vision has always been to be a reference in a discipline as vast as Emergency medicine. The recent evaluation of our publication by our peers of the National Library of Medicine in the US and their qualification of our journal as important have comforted us in our mission. Amongst the Journal Strengths as cited by the Literature Selection Technical Review Committee were the work of the Editorial board as well as the Journal's content including « research reports, case reports, technical papers, clinical overview and education » as well as the high level of ethics policies and the high level of field experience of the authors. As for areas for improvement they are mostly pertaining to the articles layout. Such comments and suggestions prompt us to do a relooking of our Journal by improving the design and restructuring the layout while pursuing our policy based on quality and ethics.

Last but not least, our primary value remains the team work and vast experience of the members of the editorial board as well as opening to diverse disciplines which renders the journal a « Global Emergency Medicine » publication. The series of editorials published in this issue reflects our attachment to this opening. In the name of the editorial board members and in my name I would like to extend my thanks to all those who contributed to the success of this initiative.

Nagi Souaiby, MD, MPH, MHM
Chief Editor

CONTENTS

Welcome to the VIIth Mediterranean Emergency Medicine Congress in Marseille, France, the 2013's World capital of Culture.

The definition of Emergency Medicine (EM) provided by the International Federation for Emergency Medicine reads: "Emergency medicine is a field of practice based on the knowledge and skills required for the prevention, diagnosis and management of acute and urgent aspects of illness and injury affecting patients of all age groups with a full spectrum of episodic undifferentiated physical and behavioural disorders; it further encompasses an understanding of the development of pre-hospital and in-hospital emergency medical systems and the skills necessary for this development". The European Society for Emergency Medicine (EuSEM) adds some specific elements pertinent to Europe: "… It is a specialty in which time is critical. The practice of Emergency Medicine encompasses the pre-hospital and in-hospital triage, resuscitation, initial assessment and management of undifferentiated urgent and emergency cases until discharge or transfer to the care of another physician or health care professional." World Health Assembly Resolution 60.22 states that emergency care is an essential part of the public health, and calls upon governments to establish comprehensive Emergency Health Care Systems (EMHCs) which integrate pre-hospital care with stabilization, triage, immediate care and in-hospital care. Conceptually, emergency care contains out-of hospital emergency medicine services (O-H-EMS) and in-hospital emergency medical services (IN-H-EMS), which must be integrated for a complete Emergency Medicine Health Care System (EMHCS). The relative importance of the pre-hospital versus the in-hospital emergency care; the staffing, and location of in-hospital care systems have developed in Europe.

EM has developed along many separate trajectories, buffeted by widely varying political exigencies and different entrenched special interests in each country. By 2012, three fifths of EU countries have recognised EM as a specialty, making EM an official specialty throughout all EU countries. As of November 2012, the Union of European Medical Specialists (UEMS) webpage lists the specialty as "Emergency Medicine" rather than as "Accident & Emergency Medicine" as it had previously. At the meeting of the Council of UEMS in October 2011, the Section of Emergency Medicine was created by the majority of voting members. This means that Emergency Medicine is clearly recognized as a primary specialty in EU. To date, 17 EU countries implemented the specialty. All members of the Section are emergency physicians, each proposed by his or her national medical association, and each EU country has representation. The recognition of EM in EU as a whole has been the culmination of many years of work, and encourages all EU countries to create the primary specialty of emergency medicine with a 5-years training period, as recommended by the Council of UEMS.

The development of EM as a primary specialty in Europe will balance the relationship with North America, the mother of EM in the world, and give a great opportunity for sharing and elaborating together Guidelines in all fields of EM. Mediterranean Emergency Medicine Congress (MEMC) is one of the famous International congresses in Emergency Medicine in the world. It is organised by the European Society for Emergency Medicine (EuSEM) in association with American Academy of Emergency Medicine (AAEM) in one of the beautiful Mediterranean and European countries where history and culture are extraordinary. This year, the VIIth. Mediterranean Emergency Medicine Congress will be held in Marseille, France in association with the French Society of Emergency Medicine (SFMU). Located on the southeast coast of France, Marseille is the France's largest city on the Mediterranean coast and largest commercial port. Marseille is the capital of the Provence-Alpes-Côte d'Azur region, as well as the capital of the Bouches-du-Rhône department. Its inhabitants are called *Marseillais* in French and *Marselhés* in Occitan. To the east, starting in the small fishing village of Callelongue on the outskirts of Marseille and stretching as far as Cassis, are the Calanques, a rugged coastal area interspersed with small fjord-like inlets. You will enjoy the Bouillabaisse, the most famous seafood dish of Marseille. It is a fish stew containing at least three varieties of very fresh local fish; typically red rascasse (Scorpaena scrofa); sea robin (fr: *grondin*); and European conger (fr: *congre*).[67] It can also include gilt-head bream (fr: *dorade*); turbot; monkfish (fr: *lotte or baudroie*); mullet; or silver hake (fr: *merlan*), and it usually also includes shellfish and other seafood such as sea urchins (fr: *oursins*), mussels (fr: *moules*); velvet crabs (fr: *étrilles*); spider crab (fr: *araignées de mer*), plus potatoes and vegetables. In the traditional version, the fish is served on a platter separate from the broth.[68] The broth is served with rouille, a mayonaisse made with egg yolk, olive oil, red pepper, saffron, and garlic, spread on pieces of toasted bread, or *croûtes*. You will never forget this great dish.

We welcome all professionals, doctors and non-doctors involved in EM all over the world to this great event in the world capital of culture where everything will be possible. You will be part of the success of this congress.

Abdelouahab Bellou, Professor, MD, PhD
President of EuSEM
Co-President of the VIIth MEMC, Marseille, 8 to 11 September, 2013.

Chemical Threats

Rapid cyanide detoxification[1,2]

- Antidotes for all forms of Cyanide poisoning[3]
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[1] Toffis V. Importance de l'intoxication cyanhydrique au cours de l'inhalation de fumées d'incendie. Intérêt de l'action antidotique de l'hydroxocobalamine. DEA de Toxicologie Fondamentale et Appliquée, Créteil 1989 **[2]** Houeto P. Relation of blood cyanide to plasma cyanocobalamin concentration after a fixed dose of hydroxocobalamin in cyanide poisoning The Lancet, Volume 346, Issue 8975, Pages 605-608. **[3]** A. Dueñas-Laita, G. Burillo Putze Bases et al. del manejo clínico de la intoxicación por humo de incendios, Medicina Intensiva 2010, 34-9; 609-619. **[4]** Guidotti T. Acute cyanide poisoning in prehospital care: new challenges, new tools, for intervention. Prehosp Disaster Med. 2005;21(2):s40-s48. **[5]** la revue des SAMU, Médecine d'urgence , Tomme XXXII, N4, June 2010, 263-267.

* When compared to the previous 2 vial presentation

CYANOKIT 5 g powder for solution for infusion. PHARMACEUTICAL FORM: Dark red crystalline *powder for solution for infusion (IV):* 1 vial (containing 5 g of hydroxocobalamin) + 1 sterile transfer device + 1 sterile intravenous infusion set + 1 sterile short catheter for administration to children. **COMPOSITION*:** After reconstitution with 200 ml of diluent, each ml of the reconstituted solution contains 25 mg of hydroxocobalamin. **INDICATIONS:** Treatment of known or suspected cyanide poisoning in all age ranges. Cyanokit is to be administered together with appropriate decontamination and supportive measures. **POSOLOGY AND METHOD OF ADMINISTRATION*: Initial dose:** *Adults:* 5 g. *Paediatric population:* 70 mg/kg body weight not exceeding 5 g.

Body weight in kg	5	10	20	30	40	50	60
Initial dosage in g in ml	0.35 14	0.70 28	1.40 56	2.10 84	2.80 112	3.50 140	4.20 168

Subsequent dose: Depending upon the severity of the poisoning and the clinical response, a second dose may be administered. *Adults:* 5 g. *Paediatric population:* 70 mg/kg body weight not exceeding 5 g. **Maximum dose:** *Adults:* 10 g. *Paediatric population:* 140 mg/kg not exceeding 10 g. **Renal and hepatic impairment:** Cyanokit is administered as emergency therapy in an acute, life-threatening situation only and no dose adjustment is required in these patients. **Method of administration:** Initial dose of Cyanokit is administered as an intravenous infusion over 15 minutes. The rate of intravenous infusion for the second dose ranges from 15 minutes (for patients extremely unstable) to 2 hours based on patient condition. **CONTRAINDICATIONS:** None. **SPECIAL WARNINGS AND PRECAUTIONS FOR USE*: Treatment of cyanide poisoning must include immediate attention to airway patency, adequacy of oxygenation and hydration, cardiovascular support, and management of seizures. Treatment decisions must be made on the basis of clinical history and/or signs and symptoms of cyanide intoxication.** Smoke inhalation: Before Cyanokit is administered, it is recommended to check affected persons for the presence of exposure to fire smoke in an enclosed area, soot present around mouth, nose and/or oropharynx, altered mental status. Hypotension and/or a plasma lactate concentration ≥ 10 mmol/l are highly suggestive of cyanide poisoning. In the presence of the above signs, treatment with Cyanokit must not be delayed to obtain a plasma lactate concentration. Known hypersensitivity to hydroxocobalamin or vitamin B_{12} must be taken into benefit-risk consideration before administration of Cyanokit. Transient, generally asymptomatic, increase in blood pressure may occur with a maximal increase toward the end of infusion. Effects on blood cyanide assay: Draw the blood sample before initiation of treatment with Cyanokit. Interference with burn assessment due to red colouration of the skin: skin lesions, oedema, and pain are highly suggestive of burns. Interference with laboratory tests because of hydroxocobalamin's deep red colour: Caution is required when reporting and interpreting laboratory results. Interference with haemodialysis: Hydroxocobalamin may cause haemodialysis machines to shut down due to an erroneous detection of a 'blood leak'. This should be considered before haemodialysis is initiated in patients treated with hydroxocobalamin. Use with other cyanide antidotes: has not been established; they must not be administered concurrently in the same intravenous line. **INTERACTION*. FERTILITY, PREGNANCY AND LACTATION*:** *Pregnancy:* There are no adequate data from the use of hydroxocobalamin in pregnant women and the potential risk for humans is unknown. However, taken into account that no more than two injections of hydroxocobalamin are to be administered, the potentially life threatening condition, the lack of alternative treatment, hydroxocobalamin may be given to a pregnant woman. Health care professionals are requested to promptly report the exposure during pregnancy to the Marketing Authorisation Holder and to carefully follow-up on the pregnancy and its outcome. *Breast-feeding:* Because hydroxocobalamin will be administered in potentially life-threatening situations, breast-feeding is not a contraindication to its use. In the absence of data in breast-fed infants, breast-feeding discontinuation is recommended after receiving Cyanokit. **UNDESIRABLE EFFECTS*:** *The most frequents:* reversible red colouration of the skin and mucous membranes, marked dark red colouration of the urine. *Reported in association with Cyanokit use, without frequency estimations:* Decrease in the percentage of lymphocytes; allergic reactions including angioneurotic oedema, skin eruption, urticaria and pruritus; restlessness; memory impairment, dizziness; eye disorders such as swelling, irritation, redness; ventricular extrasystoles; transient increase in blood pressure, hot flush; pleural effusion, dyspnoea, throat tightness, dry throat, chest discomfort; abdominal discomfort, dyspepsia, diarrhoea, vomiting, nausea, dysphagia; pustular rashes (face and neck); headache; injection site reaction; peripheral oedema; artificial elevation or reduction in the levels of certain laboratory parameters. **OVERDOSE*:** Treatment is directed to the management of symptoms. **PHARMACODYNAMIC PROPERTIES*:** Antidotes, ATC code: V03AB33. *Mechanism of action:* Each hydroxocobalamin molecule can bind one cyanide ion by substituting the hydroxo ligand linked to the trivalent cobalt ion to form cyanocobalamin, a stable, non toxic compound that is excreted in the urine. **PHARMACOKINETIC PROPERTIES*. PRECLINICAL SAFETY DATA*. INCOMPATIBILITIES*:** Cyanokit must not be mixed with other medicinal products except the recommended diluant. No simultaneous administration of hydroxocobalamin through the same intravenous line with the following drugs: diazepam, dobutamine, dopamine, fentanyl, nitroglycerin, pentobarbital, phenytoin sodium, propofol, thiopental, epinephrine, lidocaine hydrochloride, adenosine, atropine, midazolam, ketamin, succinylcholine chloride, amiodarone hydrochloride, sodium bicarbonate, sodium thiosulfate, sodium nitrite, ascorbic acid. Simultaneous administration of hydroxocobalamin and blood products through the same intravenous line is not recommended. **SPECAIL PRECAUTIONS FOR STORAGE*:** Do not store above 25°C. The reconstituted solution has to be used immediately. **SPECIAL PRECAUTIONS FOR DISPOSAL AND OTHER HANDLING*:** The vial is to be reconstituted with 200 ml of diluent (sodium chloride 9 mg/ml (0,9 %) solution for injection) using the supplied sterile transfer device. The intravenous infusion set provided in the kit must then be used. **MARKETING AUTHORISATION HOLDER:** Merck Santé s.a.s., Lyon, France. **MARKETING AUTHORISATION NUMBER:** EU/1/07/420/002

*For more information, please refer to the SmPC on the EMA website.
Please always refer to full prescribing information applicable in your country, which may vary. This prescription only medicine may not be available in your country.
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IRODAT - INTERNATIONAL REGISTRY IN ORGAN DONATION AND TRANSPLANTATION. THE MEDITERRANEAN REGION 2012

IRODaT : El Registro Internacional de Donación y Trasplante de Órganos: la región del Mediterráneo.

ARAIZ BURDIO J.J, GUTIEREZ ROMERO M.T, PARACUELLOS M.J, ROYO PUERTO M, SANCHEZ MIRET J.I. Perception of organ donation in ethnic minorities in Spain. Med Emergency, MJEM 2013; 15: 5-7
Keywords: Donation, Survey, Opinion, Minorities

ABSTRACT

Introduction: the International Registry in Organ Donation and Transplantation (IRODaT) seeks to support the transplant community by providing up-to-date data donation and transplantation worldwide. The database provides actualized and validated information provided by a network of professionals directly involved in the various stages of the donation and transplantation process. All collected data are available online, through IRODaT website www.irodat.org, so professionals may use them as descriptive and epidemiological reference. The registry provides statistics on actual deceased donors, donors after cardiac death and living donors, as well as on specific organ transplantation activities related to the three types of organ donation. All numbers are continuously checked, updated and validated and, when needed, responsible representatives are contacted for the required statistics.

Materials: data on organ donation and transplantation from 2011 and 2012 have been collected from 11 counties around the Mediterranean region.

Results: the information reveals remarkable differences between areas and type of donor, such as Croatia, Spain, Portugal, Slovenia and Italy have ones of the best rates in actual deceased donors in the world, and Turkey, Cyprus and Lebanon as well, but regarding rates on living donors. IRODaT provides data concerning the organ donation and transplantation activity for the general public and professionals around the world.

Conclusion: national and comparative generated on an international basis can be provided that is of extreme value to scientific programs and social and governmental bodies because they can support different initiatives of current practices in organ donation in any countries of the world.

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Conflict of interest statement:
There is no conflict of interest to declare


Maria Paula Gómez

RESUMEN

Introducción: el Registro Internacional de Donación y Trasplante de Órganos (IRODaT) tiene como misión dar soporte científico a la comunidad profesional dedicada al mundo del trasplante, ofreciendo datos actualizados diariamente de donación y trasplante alrededor del mundo. La base de datos proporciona información veraz y validada que ha sido obtenida a través de una amplia red de profesionales que participan directamente en las diferentes etapas del proceso de donación y trasplante. Todos estos datos recogidos y clasificados están disponibles en línea, a través de la página web de IRODaT www.irodat.org, para que puedan ser utilizados como referencia descriptiva y epidemiológica. El registro proporciona estadísticas de donantes cadavéricos, donantes vivos y la actividad de trasplante de órganos. Todos los números que se encuentras disponibles en IRODaT están en constante revisión y validación, y cuando es necesario se vuelve a contactar con el responsable para el dato requerido.

Materiales: para este artículo se ha recopilado información de donación y trasplante de los años 2011 y 2012 de 11 países de la región del Mediterráneo.

Resultados: el análisis revela diferencias entre áreas y tipo de donante, tales como Croacia, España, Portugal, Eslovenia e Italia, que tienen unas de las mejores tasas de donante cadavérico en el mundo, y Turquía, Chipe y Líbano también, pero con respecto a la tasa de donante vivo. IRODaT suministra datos relativos a la donación y trasplante de órganos para el público general y los profesionales de todo el mundo.

Conclusiones: el Registro puede generar comparaciones a nivel nacional e internacional, información que resulta ser de un gran valor para programas científicos y para organismos sociales y gubernamentales, ya que pueden dar soporte a distintas iniciativas y a las prácticas actuales en materia de donación de órganos alrededor del mundo.

Palabras Clave: Donación, Encuesta, Opinión, Minorías.

INTRODUCTION

Organ transplantation is the best therapeutic alternative for patients with terminal organ failure. Furthermore, to make the transplant possible, it is needed to develop an organ donation program. Currently there are 103 countries in the world which perform some organ transplant activity.

The World Health Organization, in its resolution WHA63.22 of May 2010, asked the countries to collect data regarding transplantation practices and the safety, quality, efficacy and epidemiology of these activities.

OVERVIEW

The International Registry in Organ Donation and Transplantation (IRODaT) was created in 1998 as an initiative of TPM (Transplant Procurement Management).

IRODaT main objective was to collect annual data about donation and transplantation activity worldwide. In 2010 the registry was transferred to the Donation and Transplantation Institute (DTI foundation) with the aim to improve and renew its methodology. Currently, the registry is 15 years old, and it has data of approximately 80 countries, being it the oldest registry in the world offering data in this field.

METHODOLOGY

IRODaT Registry works in 3 different steps, in order to offer actualized and validated data regarding organ donation and transplantation activity worldwide. The first step is to contact twice a year with the official reporters, residents in their own country. Secondly it is to collected the data, validated it and uploaded it to the IRODaT website www.irodat.org. Reporters are the responsible person of their own data. Later on, a dissemination plan, which includes the edition of two IRODaT newsletters per year, presentation in international congresses and data publication in scientific journals, is performed.

IRODaT require to their reporters to present data based on the definitions created by the World Health Organization in their document"Global Glossary of Terms and Definitions on Donation and Transplantation". For example, when referring to Deceased donors, reporters are requested to deliver"Actual Deceased donors" data.

RESULTS

IRODaT Registry presents in this issue an update on the results of the organ donation and transplantation activity in the Mediterranean region developed during the last year 2012, compared to 2011.

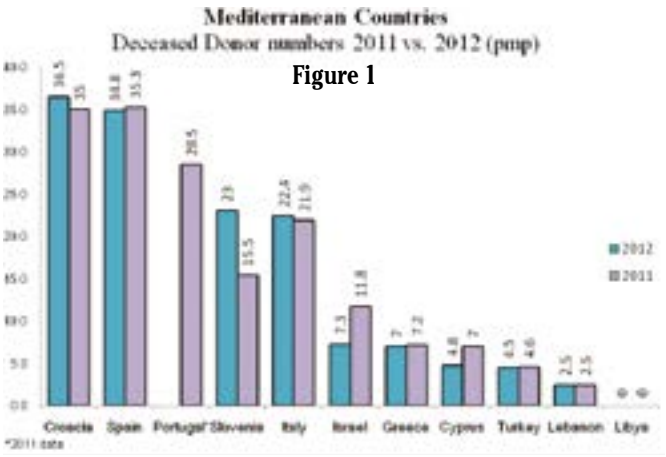

Figure 1

Figure 1 shows the evolution on the Actual deceased donation in the countries around the Mediterranean Sea. Croatia (36.5 pmp) and Spain (34.8 pmp) have the highest rates of the Actual deceased donors in the Mediterranean area. Slovenia has shown the greatest increase 15 pmp in 2011 to 23 pmp in 2012.

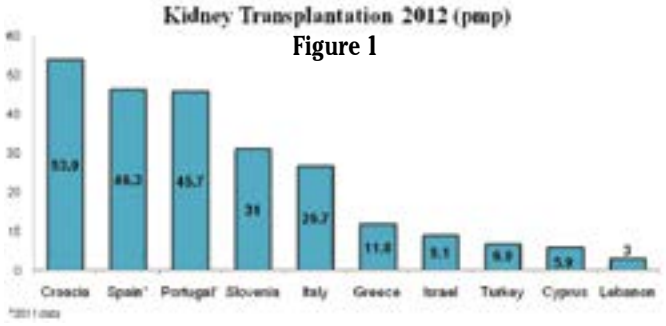

Figure 1

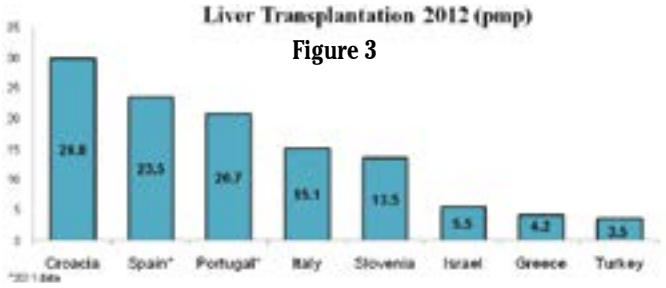

Figure 3

Regarding organ transplantation, Croatia and Spain report the major activity in kidney, liver transplant **(Figure 2-3)**, being Portugal the country with the highest rate of Pancreas transplantation **(Figure 4)** and Slovenia in Thoracic organs **(Figure 5)**.

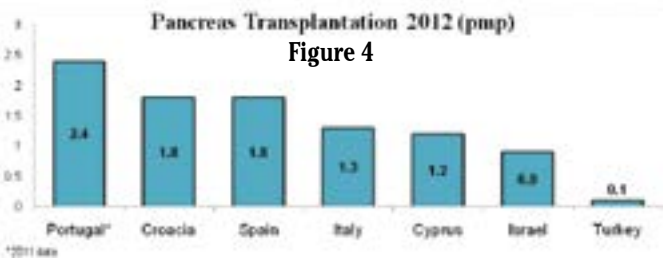

Figure 4

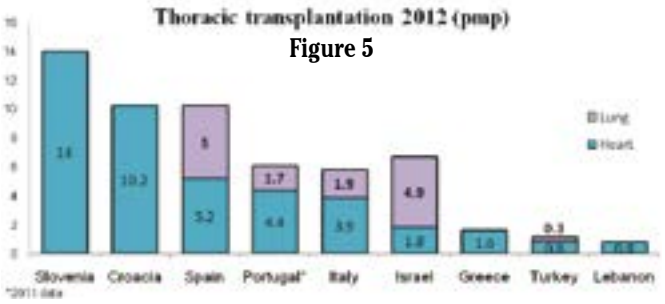

Figure 5

In living kidney transplantation, the highest rates are shown in Turkey, Cyprus and Lebanon reporting 21, 28 and 22 pmp respectively **(Figure 6)**.

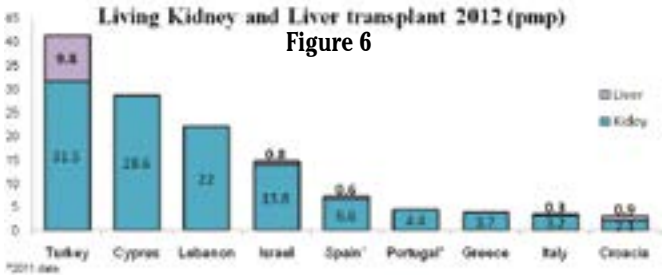

Figure 6

Thanks to IRODaT Registry, we are able to show and compare activity regarding organ transplantation around the globe.

CONCLUSIONS

The Mediterranean Countries scenario of both deceased and living organ is extremely varied. IRODaT is able to provide basic statistics within a short timeframe, based on a worldwide network of experts involved in organ donation and transplantation.

The data have proved to be of an extreme value to scientific programs, social and governmental bodies.

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HAND BLOCK AT THE WRIST.
ALR aux urgences : les blocs de la main

H. LEFORT, A. MENDIBIL, PE. ROMANAT, O.MAURIN, L. ALHANATI, M. VIOLEAU, L. DOMANSKI, JP. TOURTIER. Local and regional anesthesia in the emergency room: hand and wrist bloc. Med Emergency, MJEM 2013; 15: 8-11
Keywords: Local and regional analgesia, peripheral nerve block, emergency department, hand, wrist

ABSTRACT

Ulnar, median and radial nerves blocks are techniques used for managing hand traumas in the emergency room such as fractures, dislocations, lacerations and pain. Using those blocks will in most cases allow the emergency treatment of hand trauma without necessarily using neurostimulation nor ultrasound: it consists of injecting a sufficient amount of xylocaine near the nerve to allow it to diffuse safely causing the blockade. In France, and since 2002, the French Society of Anesthesia and Reanimation (SFAR), and the Service d'Aide Médicale Urgentes (SAMU) in addition to the French Society of Emergency Medicine (SFMU) allow emergency physicians to practice LocoRegional Anesthesia: in other words, the application of locoregional anesthesia by. The updated recommendations of 2010 by these societies suggest the spread of local and regional anesthesia in emergency medicine. The aim of this work is to describe local and regional anesthesia of the wrist.

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RÉSUMÉ

Les blocs des nerfs ulnaire, médian et radial sont des techniques de choix dans l'abord de la main traumatisée en urgence: fracture, luxation, plaie, douleur par exemple. L'anatomie fonctionnelle doit être connue et comprise. La réalisation de ces blocs permet dans la majorité des cas le traitement en urgence d'une main traumatisée, sans avoir recours nécessairement à la neurostimulation ou encore à l'échographie: le principe étant de déposer à proximité du nerf une quantité de xylocaïne suffisante permettant l'anesthésie de celui-ci par diffusion et en sécurité. En France et depuis 2002, la Société Française d'Anesthésie et de Réanimation (SFAR), le Service d'Aide Médicale Urgente (SAMU) ainsi que la Société Française de Médecine d'Urgence (SFMU) autorisent le médecin urgentiste à pratiquer les anesthésies locorégionales de la main : Pratique des anesthésies locales et locorégionales par des médecins non spécialisées en anesthésie-réanimation. Les recommandations actualisées de 2010 par ces mêmes sociétés savantes propose de diffuser plus largement les techniques d'ALR en médecine d'urgence. Le but de ce travail est de faire le point sur les blocs au poignet

INTRODUCTION

Traumas to the upper limbs are causes for seeking urgent medical attention, especially to the hands and fingers. Ulnar, median and radial block were recommended by SFAR-SFMU's experts to be used by emergency physicians without referring to neuro-stimulation or ultrasounds: local and loco-regional block practiced by non-anesthesiologist emergency physicians in the emergency room [1]. The main objective of this article is to present three blocks that can be used before hospitalization in addition to the emergency room **(figure 1)**. Although not commonly used, they are easily taught [2, 3] allowing a proper handling and management of hand traumas with good analgesia and with improved initial evaluation to assess the further plan: simple treatment in the emergency room or specialist consultation for surgical management [4, 5].

Figure 1 : Credit SSA/H Lefort: open wound exploration under LRA; French Licorne operation in Agnibelikrou region - Ivory cote.

Anatomy recaps

The sensorimotor median and ulnar nerves in addition to the pure sensory radial nerve (from the wrist and distally) innervate the hand and fingers. It is necessary to understand that the three sensorial territories do not overlap: Specific dermatomes for the superficial and subcutaneous zones, myotomes for muscular innervation, and sclerotome for deep sensation of bones and ligaments. This multiple sensorial variability enforces certain precautions [6]. Patient's involvement allows us to know if the anesthesia is good enough to explore the injured area, which might necessitate the blocking of one or more nerves at the wrist. For example for a deep injury of the thenar eminence, not only should the radial and median nerves be anesthetized but so should the ulnar nerve which innervates the adductor muscles of the thumb.

Aim, contra-indications and indications

Before doing any local and regional anesthesia from the wrist and distally, it is important to evaluate the risk-benefits and rule out possible contra indications: extensive skin infections to the involved area(s) imply the need to consult a specialized surgeon. In addition, local and regional anesthesia should not prevent possible need for specialized care later on (regional or general anesthesia) [1, 4, 6]. Local and regional anesthesia allows an initial evaluation, and sometimes treatment of, hand traumas in the emergency room [7]. The indications are numerous: deep and extensive lacerations, crush injury, foreign body removal, reduction of fractures and dislocations, pain control for large injuries, burn injuries [8]. These blocks are well tolerated by patients during wound exploration by an emergency physician but are also more efficient when compared to systemic analgesia far from the trauma area and skin injuries [4, 5, 7].

Safety and patient prepping

An initial complete physical exam including vital signs monitoring (non invasive blood pressure, heart rate and pulse oximetry) with proper charting and documentation, are a must before applying a locoregional anesthesia. The physical exam is general and systematic and looks for a focus of infection, with documentation of the sensorimotor exam of the wrist, hand and fingers [6]. A peripheral venous access is inserted, with constant vital sign monitoring, the patient is positioned supine and decubitus, with the injured hand placed on a table at the level of the bed allowing for proper handling of the injury [4,5].

Locoregional anesthesia of the hand for the emergency physician, depends on the success of blocking the specific area, knowing that he/she cannot refer back to neurostimulation or portable ultrasound [7]. Therefore a large enough volume of lidocaine should be injected at a safe distance from the nerve allowing it to be anesthetized by diffusion. We advocate the use of a 25 mm short 25-27 gauge needle with a small bevel; however a subcutaneous needle can also be used. For the median and ulnar nerve, the bevel's direction is toward the nerve axes, with a 45 degree angle directed towards the elbow. If while introducing the needle, the patient withdraws his arm this means that the needle will get further away from the injection site **(figure 2)**. The syringe used must be adequate for the needed dose, 5-10 mL. Only 1% or 2% lidocaine without epinephrine is recommended, to avoid its effect of peripheral vasoconstriction (for a locoregional anesthesia of around 2 hours). After numbing the skin, lidocaine is injected after checking by aspiration intradermally while withdrawing the needle.

The hand is rested and fixed until the end of the anesthesia to prevent secondary injuries due to hand numbness and loss of feeling [4].

Complications are rare and easily preventable. The patient is informed of the details of the procedure to get his consent and cooperation during the locoregional anesthesia in order to detect any sign of systemic side effect of the lidocaine, such as convulsions which are often preceded by prodromes (tinnitus hyperacusis, perioral dysesthesia, metallic taste, malaise, logorrhea…), cardiac arrhythmia and hypotension. Allergy to

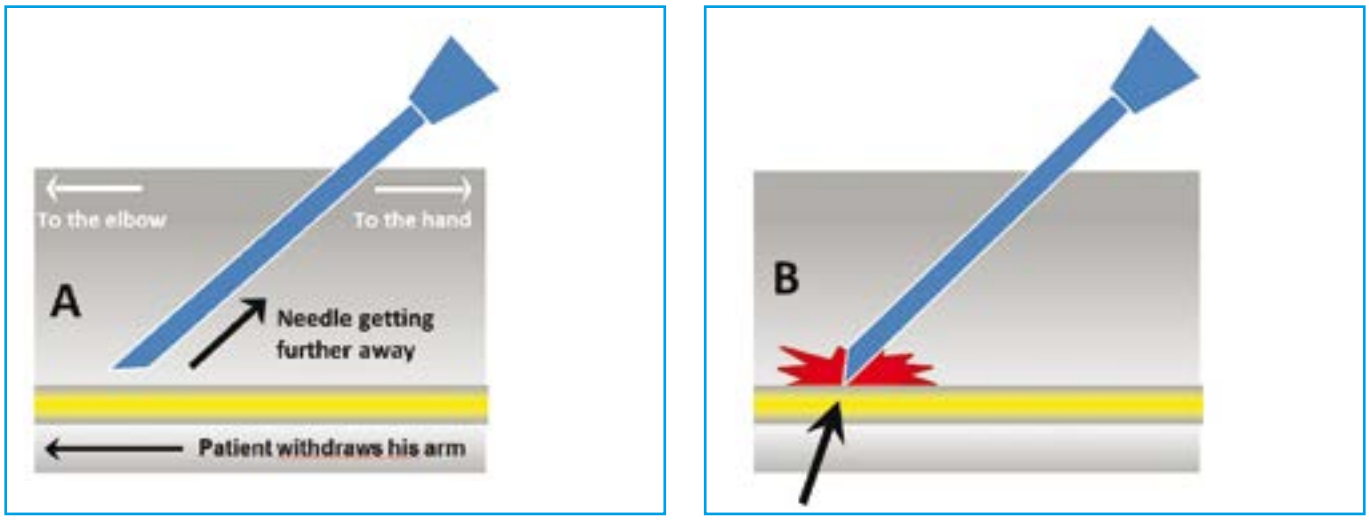

Figure 2 : Figure A shows the proper direction of the bevel when needle is inserted. Figure B shows the injury to the nerve if the bevel if introduced in wrong way.

lidocaine is rare. Vasovagal syncope may occur which requires constant monitoring and immediate intervention from the medical team whose response may vary from oxygenation to administering atropine (20μg/kg) if needed [1, 7, 9]. Trauma to the nerve can occur by direct contusion or by compression which will result in severe pain requiring the cancelation of the procedure including clinical reevaluation and observation, the patient being informed to follow up with a specialist in the next few months. The injection should be done under strict sterile field, away from any septic focus and after thorough sterilization [4, 6, 10].

Ulnar nerve block

The ulnar nerve is responsible for the sensory innervation of the fifth digit and the medial half of the fourth digit, and the corresponding part of the palm. Its deep innervation is responsible for certain thumb muscles and interosseus muscles of the hand. There is an anastomosis between the ulnar and median nerve, which causes their respective territories to overlap [6]. However, we know for certain that we need only block the ulnar nerve for any injuries solely confined to the fifth digit. The hand is placed supine in dorsiflexion and the ulnar nerve is blocked before the division into two branches **(figure 3)**.

The needle is inserted under the tendon of the flexor carpi ulnaris muscle close to its distal attachment just above the styloid process of the ulna. Three to 5mL of lidocaine is injected to a depth of 5-10mm while maintaining distance from the carpal tunnel [4].

Median nerve block

The median nerve passes through the extensor retinaculum and the carpal tunnel. It is responsible for sensation in the radial half of the palm, external integuments, and the first three fingers in addition to the half of the fourth finger. It also innervates the integuments of the second and third phalanges of the second and third fingers and half of the fourth finger. The blockade of the median nerve **(figure 4)**; the needle is inserted between the tendons of the palmaris longus and flexor carpi radialis. The needle is inserted until it pierces the deep fascia, around 10-15 mm. Three to 5 mL of local anesthetic is injected. The superficial branch of the median nerve is blocked by injecting lidocaine while retrieving the needle [4].

Radial nerve block

The radial nerve is located superficially on the extensor retinaculum. Its sensory part is limited to the external half of the

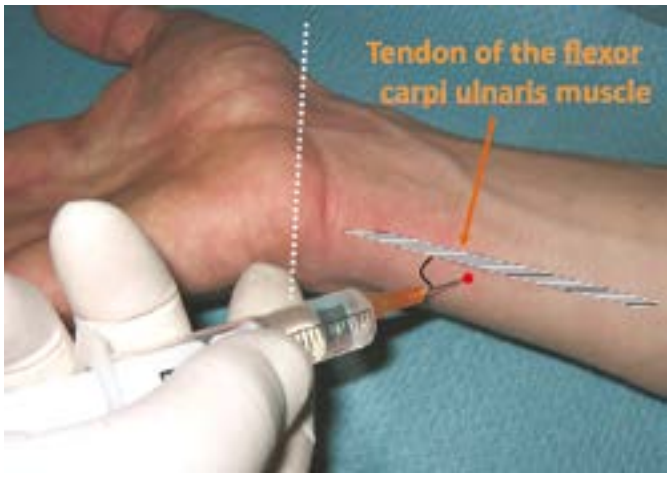

Figure 3: ulnar nerve block

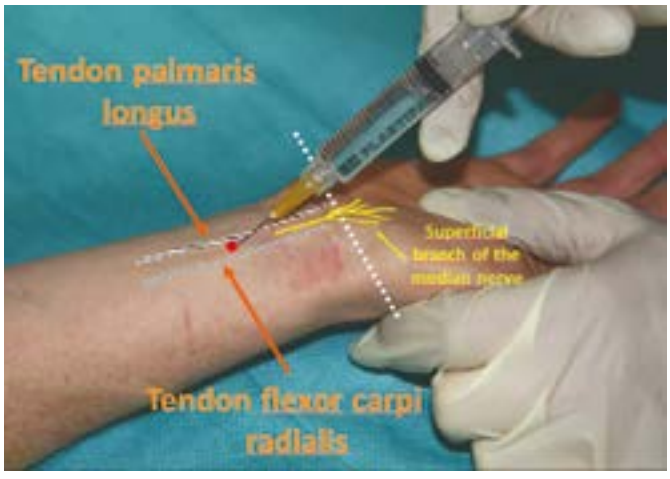

Figure 4 : median nerve block

dorsum of the hand. To block the radial nerve, local anesthetic should be injected subcutaneously, proximal to the snuff box, just above the radial styloid **(Figure 5)**. Aiming medially, the infiltration is then extended perpendicularly, using larger amounts for a total of 6mL to block the numerous branches.

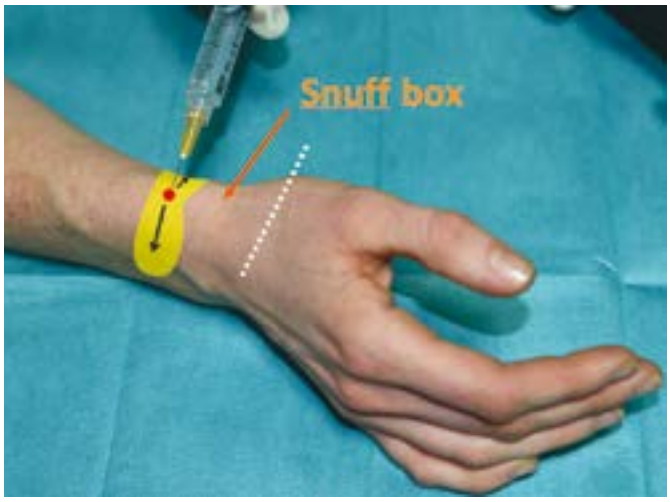

Figure 5 : Radial nerve block.

CONCLUSION

The blocks of the hand at the level of the wrist are locoregional anesthesia techniques which can easily be used for the comfort and management of hand trauma patients. These techniques are widely and frequently used in the emergency room. Our recommendations are to encourage their use thus allowing a safe and easy practice for the emergency physician. Easily taught, locoregional anesthesia requires minimal resources for patient management and satisfaction. They should be more implemented in most emergency rooms.

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MASSIVE BURN CASUALTIES IN SWITZERLAND: THE BURN ALARM PLAN

RAFFOUL W, SAÏD J-M, BERGER M. M. Massive burn casualties in Switzerland: The burn alarm plan. Med Emergency, MJEM 2013; 15;13-16
Keywords: burn casualties, burn alarm plan, Switzerland.

ABSTRACT

Disaster involving many burn patients constitutes a major problem in terms of sanitary management.

Based on the observation that catastrophe plans not dedicated to burns fail in case of burn disasters, many countries have successfully implemented concepts specifically tailored have been able to face such events. The Swiss plan development is described including the practical consideration for implementation.

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INTRODUCTION

Disaster involving many burn patients poses, in all countries, worldwide, a major problem of sanitary management. Basically, it is important to distinguish between disasters including burned few burn casualties among other victims, and those where burn injuries prevail: in the latter case the number of casualties is generally elevated. Every year in Europe, a sinister causing more than 200 severely burned victims occurs somewhere 1. So far, fortunately, Switzerland was spared, which is actually a condition that increases the probability of an event. In Switzerland, the treatment of stationary burn patients as recommended by the American Burn Association (ABA) criteria is under the responsibility of the Lausanne and Zürich burn centers. Under normal circumstances, the existing facilities are sufficient to ensure optimal treatment of the civilian victims. However, when a disaster occurs causing many burn victims, these resources face deadlocks.

Switzerland has some particularities: the country is divided in 26 cantons, and has a federal ruling system. Health care (except epidemics), education and police activities are ruled at cantonal level, with a moderate level of coordination at the national level done under the form of "cantonal conferences of the service directors", the latter being the cantonal ministers of the specific services. The milice army has a sanitary section with civilian physicians and nurses that receive additional trauma training: the army's mission is "subsidiary" of civilian facilities in case of catastrophes, but there are no military hospitals or ruling activity. The cantonal organization of health care and of medical rescue systems, incurs a difficult coordination: the latter characteristic increases the organization challenges in case of a major event.

Major burns belong to the most devastating injuries, requiring very prolonged specialized care. In addition the initial field assessment

is very difficult, with both under- and over-assessment 2, and the final extension of injury is only visible by the end of day 3, as the wound evolves during the first hours after injury. The burn competences and treatment facilities are sparse in all countries, leading to overwhelming of the centers in case of events with large numbers of major burns. Non specialized casualty plans have been shown to fail in case of burn disasters 3. International support is limited as the resources are scare in all countries. Countries such as the Netherlands that have successfully implemented concepts specifically tailored have been able to face such events 4,5. The plans are generally based on the development of a network of emergency teams and of hospitals 6,7. The summary of the Swiss plan 8 presented hereafter describes in telegraphic style the practical requirements to consider for the implementation of the alarm Plan in the event of a massive influx of burn victims

OBJECTIVES

Recognizing absence of national expertise in the field, the Swiss working group based the development of the Swiss plan on experience from international countries having faced such terrible events. In particular, the emergency medicine master of Dr Sénéchaud dedicated to burn mass casualties and which was supervised by international specialists was used as reference 6. The operational implementation of the burn alarm plan was then based on the following pre-requisites identified in the master:

- The development of a specific alarm plan to deal with a major disaster with a high number of burned patients
- The identification of a network of Swiss hospitals
- The classification and stratification of competences of the existing hospitals (specialized, 1st and 2nd level) **(Table 1)**
- The implementation of the alarm plan in emergency health call centers (including rescue) and the helicopter rescue systems
- Extension of the alarm plan on the whole Swiss territory using the software developed by the army to determine bed capacities
- Appropriate training programs to ensure specialized training for the concerned emergency teams
- Contacts with burn centers abroad
- Organizing simulation exercises (Proof-of-Concept)

Table 1: stratification of the hospital facilities

1	Burn centers	University hospitals of Lausanne and Zurich. Children's hospital in Zurich
2	Level 1 hospitals	Other university hospitals, cantonal hospitals with intensive care units ICU). Level A continuous training according to the Swiss society of Intensive care (SSMI) Presence of plastic surgeons
3	Level 2 hospitals	Hospitals with ICU's Level B continuous formation according to SSMI General surgeons

THE PROCESS

1- Triggering of the alarm plan

The normal rescue system should be used as far as possible: extraordinary things that "never" happen, do not work when required. The Director of medical rescue (DMS) is in charge of triggering the alarm plan after an initial assessment of the scene and consideration of the predefined criteria. The cutoff number of casualties defined as a burn catastrophe in Switzerland is 15 and up **(Figure 1)**.
If no medical director is available, the decision will be up to the sanitary intervention chief (in Switzerland this person is not necessarily a physician).
The "local cantonal" central, also called "144" (its emergency phone number), is in charge of emergency calls, and informs the helicopter rescue service about the event. The transportation of the patients (noria) will be organized according to the plans developed for other major disasters, with the support of the army.
In terms of intervention, in the Swiss system, the responsibility is cantonal and their sanitary teams which would be coordinated in case of a major event. The helicopter rescue system is responsible for transporting patients entrusted to it, to the determined hospitals

Fig 1: Event qualification based on casualties number

2- A burn expert to assist triage

Triaging burned patients is difficult and may require trained specialists. The precise estimation of burn injuries is very difficult and may result in hospitalizations in an inadequate facility. Therefore it is recommended that the Director of medical rescue considers the support of a burn specialist from one of the burn centers, particularly in present of more than 50 casualties.

3- Possible support by a burn expert for referral hospitals

A burn expert team requires plastic surgeons, intensive care physicians and specialized nurses from the burn centers. These teams can strengthen non-burn hospital teams to make a new assessment of patients, to assist and to advise the caregivers. When asked to admit burn patients, non specialist hospitals may also seek the advice of expert burn teams: hospital calls and web exchanges of photos of the patients are encouraged. Indeed, the burns center teams being heavily involved in the treatment of an increased number of patients, over their normal capacity, will not be able to visit other hospitals. This process is therefore not binding for the burns centers.

IMPLEMENTATION

After elaboration, the plan must be implemented. Switzerland is in this phase, and has started with addressing prehospital care. Training of the network of subsidiary hospitals will follow.

1-Implementation in pre-hospital care

Prehospital implementation is based on three pillars:

1. The continuous training of medical rescue directors and Heads of sanitary intervention to assess the situation in situ and trigger the alarm plan. The training will mainly focus on the triage criteria for the distribution of patients between adequate hospitals.
2. The integration of the program into the various processes and workflows of the cantonal rescue systems
3. Implementation of the plan at the helicopter rescue company (in Switzerland a non-for profit company with the acronym REGA realized the majority of the air-transports). The helicopter rescue company together with the Army's central alarm team will alert the hospitals, and asses the available bed capacities and, if depending on the size of the event, call and transport a burn expert for triage.

2-Implementation in hospitals

The number of specialized beds is limited. In Switzerland, the critical care capacities under normal circumstances is sufficient for civilian accidents with 11-12 adults and 2-4 pediatric ICU beds and about the same number of non-ICU beds. They are occupied 90% of the time leaving few beds free in case of a major event.

2.1 Classification of hospitals

The hospitals have been classified into three categories **(table 2)** in order to properly manage an influx of massive burns. Obviously university hospital and large cantonal hospitals have by definition more competences that make them able to face unusual situations. The hospital categories are included in the army's information system and will be used stepwise depending on the size of the event to care for burn patients.

Table 2: Proposed distribution of burn injury severity according to the type of hospital, and the number of casualties.		
Hospital type	**Up to 50 casualties**	**Over 50 casulaties**
Burn center	Adults >30% BSA Children > 20% BSA complex lesions Associated multiple trauma	idem
Level 1	Adults 20-30% BSA children 10-15% BSA Inhalation injury	Adults <30% BSA children <20% BSA Inhalation injury
Level 2	Adults < 10% BSA	Adults < 15% BSA

2.2-Continuous training of doctors and nurses

Lausanne and Zurich burn centers offers on regular basis continuous educational courses intended for medical staff and paramedics of the university and peripheral hospitals. In addition, regular training courses are also offered to the Swiss Academy of Military Medicine and Disaster.

2.3- Establishment of expert teams in burns

Teams of experts in burns are composed of physicians in charge of burn care in both Swiss burn centers. The expert teams are in charge of the organization and delivery of the national continuous educational program. In case of a disaster with massive burn influx their roles are:
- Assisting triage in the field
- Organization of the medical care in the university hospital facilities.
- Assistance of the peripheral hospitals physicians and nurses (level one and two)

FUNDING

The Swiss burn alarm plan as presented here is intended to ensure optimal use of pre-existing structures and procedures. It is primarily a matter of fitting with minimum effort with the existing plans, trainings and facilities. It therefore incurs no additional costs and requires no additional funding.

CONCLUSION

On the basis of a clear risk and recognized limits in terms of specialized burn care capacities, our country decided to create a suitable structure, based on the existing, to enable it to assume an event involving a large number of such victims. The working group inspired itself from the experience of other countries that had faced burn mass casualties in the past, and adapted it to the its federal system with 26 cantons and health care systems.

The project summarized above is essentially based on two pillars: the early involvement of specialists in Swiss Burn Centers, and the optimal use of existing resources, globalized in the form of a burn network.

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IN-SITU SIMULATION: A DIFFERENT APPROACH TO PATIENT SAFETY THROUGH IMMERSIVE TRAINING

LA SIMULATION IN-SITU: L'AUTRE APPROCHE DE LA SECURITE DU PATIENT OU L'ENTRAINEMENT EN IMMERSION

ALINIER G, SOUAIBY N, HSSAIN I. IN-SITU simulation: A differrent approach to patient safety through immersive training. Med Emergency, MJEM 2013; 15: 17-28
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ABSTRACT

Simulation is becoming more and more popular in the field of healthcare education. The main concern for some faculty is knowing how to organise simulation training sessions when there is no simulation centre as they are not yet widely available and their cost is often prohibitive. In medical education, the pedagogic objectives are mainly aimed at improving the quality of care as well as patient safety. To that effect, a mobile training approach whereby simulation-based education is done at the point of care, outside simulation centres, is particularly appropriate. It is usually called "in-situ simulation". This is an approach that allows training of care providers as a team in their normal working environment. It is particularly useful to observe human factors and train team members in a context that is their real working environment. This immersive training approach can be relatively low cost and enables to identify strengths and weaknesses of a healthcare system. This article reminds readers of the principle of « contextualisation » that is needed for the good implementation of simulation-based education in healthcare while highlighting the advantages, obstacles, and challenges to the development of in-situ simulation in hospitals. The objective is to make clinical simulation accessible to all clinicians for the best interests of the patient.

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RÉSUMÉ

La simulation en santé gagne en popularité dans le champ de l'éducation médicale. La préoccupation des formateurs en simulation est de savoir comment proposer des séances de simulation en santé alors que les centres de simulation ne sont pas encore répandus et que leur coût paraît prohibitif. Or, en formation médicale, les objectifs pédagogiques s'orientent principalement vers l'amélioration de qualité des soins et la sécurité du patient. Par sa mobilité, la simulation in-situ est une simulation réalisée « au pied du lit » (point of care), en dehors des laboratoires de simulation. Elle apparaît donc comme une méthode originale qui permet d'entrainer les soignants, en équipe, dans leurs conditions de travail habituelles, afin de mettre en jeu les facteurs humains et faire évoluer les apprenants dans un contexte proche du réel. Tout en identifiant les forces et les faiblesses d'un système de soin, cet entrainement en immersion permet également de réaliser une simulation de haute fidélité à moindre coût. Cet article rappelle le principe de « contextualisation » nécessaire au bon déroulement de la simulation et met l'accent sur les avantages, les obstacles et les défis au développement de la simulation in-situ dans les hôpitaux. Le but est de rendre accessible la simulation en santé à tous pour le bien des patients.

MOTS CLÉS : simulation en santé, simulation in-situ, développement professionnel continu, sécurité des soins, entrainement en équipe

INTRODUCTION

You are a faculty or clinical educator and you wish to expose your trainees to an efficient learning approach to improve the quality of care they deliver. You are persuaded that clinical simulation is one of the best means but you have budgetary limitations. You then wonder about how to develop simulation within your institution at low cost and with quick wins that are easily and positively noticeable in the patient care chain.

Amongst all the training opportunities that are available for healthcare providers to engage in continuing professional development (CPD), one ought to choose the teaching method that is the most appropriate in terms of cost-efficiency for hospitals and learning benefits for participants. Clinical simulation is an interesting approach that enables to confront trainees with complex and varied situations without exposing patients to risks.

Since 2012, the recommendations of the French Higher Health Authority encourage the development of clinical simulation (1). Although it has not yet been passed as legislation, the HR 855 bill made an official recommendation in the House of Representatives in the US since 2009 (2), and the Chief Medical Officer for England also recommended it for health professionals in its 2009 annual report (3). Other nations are probably to follow this movement in the near future (4).

In-situ simulation is an immersive pedagogic strategy that is inherently available to all healthcare providers in their usual working environment. It allows the analysis of their interactions and the application of their procedures within a real environment, which is their own, thus maximizing the teaching benefits and transferability.

Thanks to highly realistic scenarios, in-situ simulation can reproduce situations of risk management, crisis, or undesirable events whilst focusing on difficult decision-making in a multi-stakeholder and sometimes multidisciplinary situations.

The level of fidelity of a simulation is determined by the realism achieved in the simulation session. This is highly influenced by the facilitation style of the educators who should learn not to interfere with the scenario other than in an acting capacity. A scenario can highlight the complexity of teamwork in the day-to-day provision of health care. In-situ simulation can reach a high level of realism (or fidelity) because the session takes place in the same location where real patient care interventions happen. Without real specific preparation of the trainees about the objectives and events of scenarios they are being subjected to, "real" mistakes can be allowed to occur without negative consequences to actual patients so learning can be derived from them.

Scenarios should take into consideration the experience and concerns of healthcare professionals whilst focusing on « problem-based learning». Adults learn better when the subject of their learning has a direct impact on their professional life (5).

Konia & Yao refer to a new paradigm in learning (6). Lee et al. and Coolen et al. have highlighted the supremacy of simulation in terms of clinical performance in the field of paediatric emergencies over any other learning method (7) (8). Littlewood et al. confirm this when it comes to the management of shock cases (9).

At a time when simulation is gathering momentum and that construction of simulation centres is sometimes becoming an obstacle to delivering simulation-based education, in-situ simulation is a key alternative. It allows the facilitation of highly realistic scenarios for healthcare teams with results that can immediately be felt and at relatively low cost as it uses mostly already existing physical infrastructures.

What was known?
Simulation is an effective teamwork training approach as it allows participants to take care of a patient and experience rare event in a learning environment whilst paying particular attention to human factors.

What this article add:
High-fidelity in-situ simulation can be a very realistic multidisciplinary training approach because it is very similar to daily life clinical practice. To that effect in-situ simulation allows a more precise evaluation of human, physical, and environmental factors that, if dysfunctional, may be detrimental to clinical performance and affect patient safety. In-situ simulation requires a lot of competence on behalf of the educators but is less onerous to implement than if it was done in a simulation centre. It is perfectly fitting for use as a continuing professional development activity in order to improve clinical practice.

Suggestions for the future:
Research in the field of in-situ simulation should aim at proving its usefulness in terms of improving patient safety, teamwork, and standards of patient care in general.

1. TRAINING USING SIMULATION IN HEALTHCARE: WHAT IMPLEMENTATION STRATEGY TO ADOPT?

Starting the delivery of simulation-based education in any institution requires first the development of an educational programme aiming at convincing all stakeholders of the usefulness of such venture in terms of patient benefits.

Indeed, senior management will study the matter from a financial standpoint and will want a return on the investment (time and equipment). Therefore, they should be convinced that simulation contributes to reducing costs resulting from medical care complications. Cohen et al. estimated profit at 7/1 in a simulation-based educational programme focusing on the prevention of nosocomial blood infections following central catheter insertion through appropriate care (10). Van de Ven et al. tried to demonstrate healthcare savings thanks to reduced medical errors following simulation training with obstetrical teams (11).

Simulation allows as well to reduce risks linked to the introduction of a new activity or to practise the occurrence of rare events. It may also be eventually needed for commissioning and accreditation of new facilities or the implementation of specific medical procedures.

Simulation may also be integrated in initial healthcare training programmes and used for CPD in healthcare in order to encourage teamwork and enhance self confidence through a well conducted debriefing, for example facilitated using good judgement as recommended by Rudolph et al. (12).

Educators should be happy to develop new educational skills towards the social and behavioural aspects of training whilst reducing learning time with real patients for technical acts. Simulation scenarios provide an opportunity for another important learning experience, the debriefing, an analytical process transferrable to real patient care hence allowing improved management of medical cases (13).

Ziv et al. consider that embarking in clinical simulation is part and parcel of the « ethical » obligation of healthcare professionals (14). It is reassuring for patients to know that care providers are being trained in a highly realistic context, especially with regards to risky interventions or to be prepared to respond to crisis situations. This would increase patients' level of satisfaction and their confidence in the care providers.

Communication of these training activities ought to be widely disseminated and may attract charitable donations to support further similar of initiatives (15). This could provide support to develop other training programmes for qualified healthcare professionals in order to improve their team working skills and the quality of care they provide, whilst maintaining costs under control. In-situ simulation has its place in CPD in healthcare because it is cost effective, educationally efficient, valuable to test real healthcare systems, and potentially visible to the public.

2. CONCEPTUAL BASES OF IN-SITU SIMULATION: HOW TO RE-CREATE A REALISTIC LEARNING CONTEXT IN CLINICAL SIMULATION?

This is the question that Gaba asked twenty years ago (16). The level of simulation fidelity is defined by the level of realism attained during the activity, in other words by the extent to which the simulation activity is close to reality from the perspective of the learner.

« Simulation is a technique - not a technology – to replace or amplify real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner » (17).

However, the mistake that is commonly committed is associating the level of fidelity of a simulation session to the level of technology of the mannequin or patient simulator used. In fact, Rosen et al. establish a difference between the technological level attained by the patient simulator (technology of the simulation equipment), the simulation itself (use of the methodology which does not necessarily require a simulator) and learning by simulation (the learning process used in the educational intervention) (18).

In order to run high-fidelity clinical simulation sessions there is sometimes a need to use sophisticated simulation equipment (or some other realistic representation of the simulation focus such an actor) and to have a highly realistic physical environment, but most importantly a highly realistic psychological environment is required **(Figure 1).**

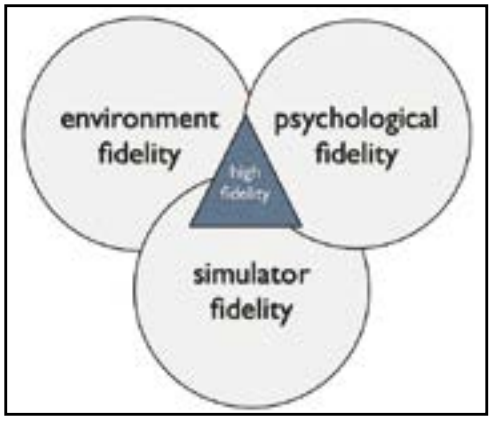

Figure 1: The elements of the high-fidelity simulation experience.

Just like a film director, a simulation facilitator has to imagine the scene in which participants will be involved as part of a scenario, bring together the equipment and accessories needed, and help create the required atmosphere so a pre-determined result is achieved. In our case, we often concentrate on learning outcomes or other key performance indicators linked to specific objectives.

2.1 Simulator fidelity (simulation tool)

Alinier identifies six types of simulation media and explained their authenticity in comparison to real life experiences. For high-fidelity simulation, interactive patient simulators are often used to reproduce accurately the various physiopathologies whilst involving a team of care providers who will have to use their cognitive, psychomotor and interpersonal skills. The patient simulator's clinical and vital signs are computer controlled. Invasive procedures can also be performed. Those simulators are very useful in medical specialities that require technical acts and the use of medical equipment or in simulation sessions that aim at improving team working as well as technical competencies (19) **(Table 1).**

Technological						
Simulation Level	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
Simulation technique	Written simulation includes pen and paper simulations or « patient management problems » and latent images	3D models which can be a basic mannequin, low fidelity simulation models or part task simulators	Screen based simulators, computer simulation, videos, software or virtual reality and surgical simulators	Standardized patients, real or simulated (trained actors) role play	Intermediate fidelity simulator, computer controlled, programmable full body size patient simulators not fully interactive	High fidelity simulation platforms Interactive patient simulators or computer controlled model driven patient simulators
Type	Passive	Interactive		Partly interactive		Interactive
Skills addressed	Cognitive	Psychomotor	Cognitive	Psychomotor, cognitive & interpersonal	Psychomotor, cognitive & interpersonal	Psychomotor, cognitive & interpersonal
Facility required	Classroom	Clinical skills room or classroom	Multimedia computer laboratory or classroom	Depends on scenario requirements	Clinical skills room or simulation center realistic setting (ex: ER)	Same as LEVEL 4 + usually set up with audio & video recording equipment

Typical use	Patient management problems, diagnosis & assessment	Demonstration & practical skills	Cognitive skills, clinical management	Same as LEVEL 2 + patient assessment, diagnosis, or management problems Interpersonal skills	Same as LEVEL 3 + procedural skills full scale simulation training	Same as LEVEL 4
Disadvantages	Unrealistic Poor feed back	Little interactivity	Unrealistic setting Difficulty to use computer	For small groups of student only Patients & actors trained No invasive practice	Programming scenario required Familiar with equipment Small group	Cost of mannequin & facility Not very portable Same as LEVEL 4
Advantages	Low cost Large number of student	Same as LEVEL 1 + equipment mobile	Same as LEVEL 2 + self learning & feedback on performance	Very realistic Communication skills Multi professional training	Realistic experience Multi professional training	Realistic experience Performance recorded for debriefing Multi professional training

Table 1: Variety of simulation tools (With kind permission from GA & Medical Teacher, adaptation by HI) (19)

Unfortunately, high-fidelity patient simulators are fragile, costly, and difficult to transport. Lee et al. have however proven that there was no difference from a learning outcome point of view between using a high-fidelity or a low-fidelity patient simulator to teach technical acts (20). A so-called low-fidelity mannequin or patient simulator is a mannequin on which certain technical acts can be performed but it has very limited or no interactive capability or software to operate it. Depending on the learning objectives, low-fidelity technology may still be used for high-fidelity simulation training purposes. In the pre-hospital care area, Bredmose et al. demonstrated that simulation sessions could easily be facilitated outdoor using so-called low low-fidelity patient simulators without negatively impacting on the realism of the experience thanks to the use of an appropriate physical and psychological environment (21).

The use of this type of simulation is reasonable and available to all but requires acceptance of the use of a relatively simple mannequin in a highly realistic physical and psychological context. This relates to the establishment of a reasonable fictional contract with the learners at the pre-briefing phase of a simulation session so they accept the limitations. In fact, the equipment is cheaper, easier to use and maintain, and can be harshly put to the test especially in the pre-hospital environment. It may not require power or other electrical connectivity, hence is more portable and less bulky to store. It is an « easy way » and affordable simulation solution that focuses on learning objectives rather than on the equipment used.

On the other hand, when we want to focus on human resource development, it is preferable to use real patients or what we call “standardised” or “simulated” patients (an actor that plays the role of a patient based on a scenario script he/she has learnt) (22). Unfortunately, it is not possible for the actors to reproduce clinical signs such as temperature, blood pressure, or pulse. In certain scenarios, they are more appropriate than any other so-called high-fidelity patient simulator. This shows that technology is not key to facilitation of high-fidelity simulation sessions. In fact, Issenberg et al. revealed in his study that low or intermediate fidelity simulators are the type of simulators most frequently used (23).

2.1 Fidelity of the physical environment

A simulation that takes place in the same location where care is provided with the material that is used on a daily basis contributes to making it high-fidelity from an environmental perspective **(Figure 2).**

Ideally the trainees should be confronted to complex clinical situations in the context of their own institutional system, which includes local guidelines, specific equipment, and the colleagues who constitute their usual team. It is therefore recommended to immerse learners in an environment that is very similar to theirs or itself directly if possible (24).

For example, when a new hospital is being constructed an additional emergency room and operating theatre that are identical to the original ones could be built for training purposes. This should also be considered when constructing a new simulation centre so it mimics the clinical environment of the hospital it serves for training purposes. The other solution is to train in the real clinical environment which may help greatly from a financial point of view as well as makes it easier to align learning objectives to local needs.

Airline pilots train every 6 months in cockpit simulators that mimic the cockpit of the aircraft that they fly routinely. During an in-situ simulation session, even patient wards may provide a suitable clinical environment **(Figure 3)**. Wright et al. even present how they have run high-fidelity simulation scenarios with an interactive patient simulator inside a flying helicopter (25).

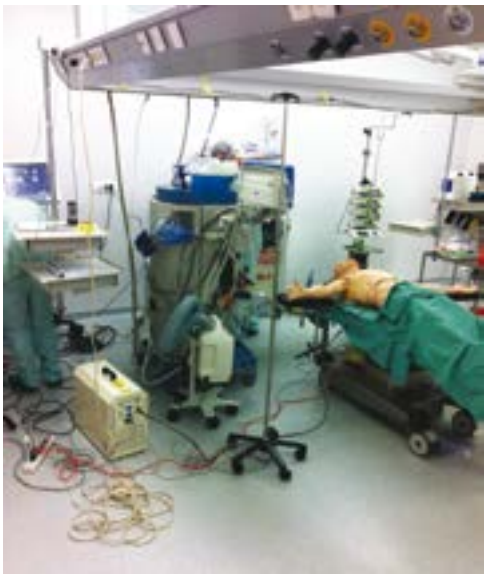

Figure 2: Simulation equipment setup in an operating theatre.

2.2 Psychological fidelity (atmosphere)

High-fidelity simulation is not only about a so-called high-fidelity patient simulator or mannequin placed in a simulation centre where an emergency room has been set up. There is a need to create psychological reality i.e. the pressure of human factors, time, stress, and a clinical context that is close to reality. One of the critical elements is the facilitation style of the educators who should allow the trainees, based on their experience, to handle the situation on their own and without any guidance. This can happen by simply having the educators standing behind a mobile partition or in a control room with an audio-visual system and from where the simulator is operated.

In high-fidelity simulation, the most important role for the educators is the psychological preparation of the trainees before the simulation so that they accept the technological limitations (patient simulator and equipment) and the context (they know that this is an exercise). The educators should make these limitations clear to the trainees and should create an atmosphere that is conducive to training throughout the succession of scenarios and debriefings.

For Müller et al. an ideal simulation session allows to re-create a stressful situation for the trainees with difficult decision making and multi-professional, multi-disciplinary interactions (Crisis Resource Management) (26). This should be done bearing in mind the simulation education continuum which is linked to the level of the trainees and may dictate the use of a lower type of simulation fidelity interaction whereby more support and prompting is provided to help them acquire skills and experience (19).

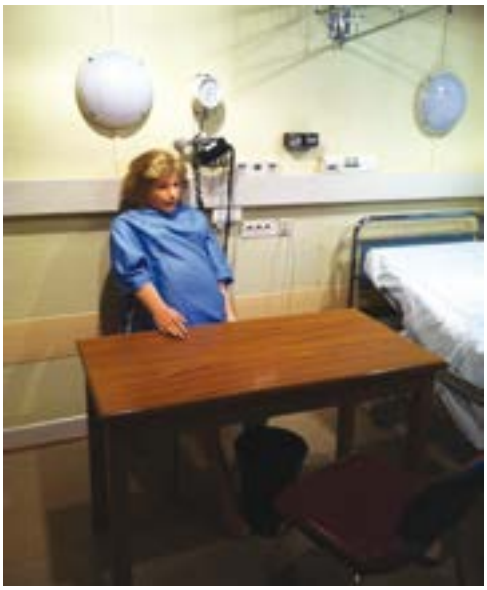

Figure 3: Patient simulator setup in a patient ward for an obstetrics scenario.

Stress reduces concentration and makes decision making more difficult. Just like in real life, the fear of harming a patient may delay the start of a treatment. In his study, Mäkinen et al. have shown that training in simulation reduces this stress (27).

The psychological environment includes all human factors and highlights organizational problems. It helps reveal the team dynamic, communication problems, leadership or even the absence of protocols.

When it comes to communication problems, Andersen et al. identify team conflicts and attempts to solve them (28). A team is not only a group of individuals who work together without a common goal but a group of persons interacting together and working hand in hand towards a common goal. Every one of them, be it the chief or a junior member of the team, is responsible for following the path to reach this goal. Buchanan considers that team spirit and motivation are at their best when the leader knows each and every team members with their strengths and weaknesses, and is capable of tasking every one of them based on their competencies and experience (29). So let us train as a team those who work as part of a team.

According to Østergaard et al. the main objective of a simulation session, and more particularly an in-situ simulation session, is to enhance this team spirit with a view to improving quality of care and patient safety (30).

In-situ simulation can be implemented in all clinical specialties even in dental care and clinical psychology (31) (32). It allows the trainees to recognize, identify, and correct their mistakes, as well as become more familiar with their environment which is one of the key points of CRM training (30).

According to Miller et al. in-situ simulation is a team simulation strategy that recreates within care units a context that is very close to reality and increases knowledge transfer amongst the various actors of a system (33).

3. IN-SITU SIMULATION

3.1 Definitions of in-situ simulation

The originality of in-situ simulation is that it does not take place in a simulation centre but is rather defined as a « point of care » training opportunity, meaning that the session is conducted in the real clinical environment. The Weinstock et al. and Paige et al. teams are its biggest supporters (34) (35).

It is noteworthy that in-situ simulation is not there to replace simulation that is performed in a centre but rather complements training objectives that are not reachable outside an actual patient care environment (36).

In fact, in-situ simulation allows the healthcare professionals to learn and develop their experiences in their usual working environment, i.e. the same location where they provide patient care, apply their knowledge, and use their experience in the best interest of patients (37). The work that is done in simulation centres enables to address a wide array of learning objectives but nothing replaces field experience where other specific lessons can be learnt. According to Mondrup et al. this field of simulation is particularly useful to identify the weaknesses of a care unit or potential errors. Implementing simulation within a system allows the early identification of all loopholes, provides an opportunity of addressing them, and improves patient safety (38). Surcouf et al. developed simulation sessions for interns who move from one service to the other and sometimes finish their internship without being confronted to a single vital emergency (39).

More recently, Møller et al. defined different types of simulation and in-situ simulation (40). In a skills laboratory or medical simulation centre training takes place in a specifically dedicated location away from patient care units. According to Møller et al. in-situ simulation takes place in a fixed or temporary unit established within the patient care environment. Møller et al. differentiate it from «mobile simulation» that may take place in real care units but all training equipment, participants, and facilitators move from one place to another during the scenario so the “patient” can benefit from the care required (40).

So according to Møller et al. in-situ simulation is about defining a permanent or temporary location within a department with the care providers of the same unit as training participants. Participants train as a team in their working place with the possibility of resorting to the professionals needed. All training equipment stays in place according to the sessions’ needs. This concept is appealing because it allows exchange between teams and within a team. This idea negates the environment fidelity concept because it only allows evolution within a very precise context with the local medical equipment until it is setup in another location (40).

«Mobile simulation » according to Møller et al. is the development of a simulation session temporarily within the care units as the scenario will require the patient to be physically transferred. It relies on equipment and material to be available in the location where care is provided as if it was for a real patient. The simulation equipment only has to be transported carefully to avoid damage. This type of simulation requires a rigorous preparation, setup phase, and technical familiarity with all elements involved (40).

Mobile simulation is the « real » in-situ simulation because it allows movement of trainers and material to the site where care is provided in order to benefit from a real clinical environment. The patient simulator can be moved from one site to another according to the patient care services required, the events, and the healthcare providers to be involved. Simulation sessions can also be performed in a pre-hospital location like on-board of an ambulance or helicopter (25) (41). Simulation within a team of trainees who normally work together makes the scenario more realistic and reinforces the learning gains.

Unknowingly to trainees, a scenario may purposefully make use of a defective piece of equipment, rely on sharing false or incomplete information to induce participants in error, and even introduce other actors to play the role of family members to disturb the session just like in real life (22). The scenario then reflects the reality to the utmost extent possible. This is can be called « natural » simulation.

This « real » in-situ simulation is high-fidelity because it is close to the environmental and psychological reality. Immersion of trainees can be optimal with the appropriate facilitation and preparation of the scenario participants. If then a high-fidelity patient simulator or well-trained simulated patient is used alongside a well-designed scenario we get very close to the perfect realism.

In-situ simulation is close to real life at all levels: technical, conceptual, and emotional. The trainees can become completely immersed in the context and with the events of the simulation experience when scenarios are designed to match their level of experience. It is the highest fidelity simulation experience possible!

3.2 Advantages, obstacles and challenges of in-situ simulation

The main advantage of in-situ simulation is the absence of need for a permanent physical location to perform training. The only thing needed is a storage place for the material for when it is not used. The simulation centre becomes « mobile ». In fact, the centre only exists when in-situ simulation sessions are taking place.

The other advantage in terms of learning and evaluation is that the whole care system can be involved in the training and even be tested with its own equipment and within daily working conditions. Delac et al. propose cardiovascular reanimation sessions every month to train nursing teams (42). The Brooks-Buza programme proposes sessions for handling emergencies at the dentist (43).

According to Shah et al. in-situ simulation is an opportunity to evaluate the performance of teams from the patient bed side right through to health administration. It enables the identification of logistical, operational, or organisational issues within an institution. It can bring up leadership and other human factor issues or simply help identify poor medical practice in normal and crisis situations (CRM) (44). It may sometimes simply be used to expose participants to rare events so they can practise (40). Sam et al. suggest that in-situ simulation forms part of university education for healthcare students (45).

For Patterson et al. in-situ simulation fits well with experiencing how to deliver bad news to patients and relatives as it allows an analysis of the problems faced where they also occur in real life (46). Real issues can be used as the base for training scenarios. In France, simulation can be used as a review method for RMM (revue de morbi-mortalité) (1).

According to both Wheeler et al. and Patterson et al. in-situ simulation helps identify existing and latent issues in the patient care environments ranging from team members' behavioural or competency issues through to system, physical, or spatial problems. Teams can be exposed to rare and critical situations. In-situ simulation can also be used to test the implementation of new protocols to ensure their applicability and discover potential issues that may otherwise not have been considered until applied in a real patient care situation (47) (48).

For example Kobayashi et al. used in-situ simulation to orientate staff and test the security of a new Emergency Department before it opened its doors for patient care. In another study Kobayashi et al. tested the arrhythmia surveillance telemetry systems of an Emergency Department. In-situ simulation helps ensure operational and patient care quality. We can envisage that it will soon formally be used for commissioning and accreditation purposes of new healthcare facilities (49) (50).

Hamman et al. and Patterson et al. demonstrated that behavioural changes of healthcare professionals occurred following in-situ simulation training; with regards to the Kirpatrick evaluation of a training intervention, it can be classified as being of level 3 (50) (51) (52).

Despite all the benefits of in-situ simulation from a conceptual and practical point of view, there are difficulties that accompany its implementation. It requires careful planning, a rigorous choice of scenarios and learning objectives, and experienced facilitators. It is accompanied by challenges, which may be technical, logistical, cultural, legal, or ethical (53). The patient simulators used should preferably be portable, tetherless, and the audio-visual system needs to be simple to install and use. All these elements should be relatively rugged as the equipment will have to be regularly moved from location to location.

The team of facilitators needs to be very familiar with all the equipment used so they can efficiently set it up and take it away after a simulation session, whilst minimising breakage. The number of scenarios that can be run may be very limited due to the time it takes to install and reset the venue. Facilitators also need to be resourceful so the patient simulator operator consol, cameras, microphones, and their wiring remain discreet and do not cause trip hazards.

During an in-situ simulation session it is often required to use disposable equipment and medicines. Either the equipment already present in the clinical environment is used, but it somehow needs to be restocked and financially accounted for, or out of date or "for training use only" equipment is brought by the simulation team and put at the disposal of the scenario participants. The latter option requires some form of storage for such equipment, a way of transporting it wherever required, and proper labelling so it cannot be confused with clinical equipment for use on real patients. Whatever approach is used, patient safety should always remain the priority and an appropriate system needs to be put in place to not mix resources or deplete the real patient care environment. This is an important issue of in-situ simulation. Another potential concern relates to infection control but this remains to be verified.

The biggest challenge of in-situ simulation is what actually happens during a session when the whole team of participants is expected to remain free to ensure no one will miss out from such learning opportunity. It should ideally be possible to run a session at any time with whichever team is present in the clinical environment. Surcouf et al. and Walker et al. suggest to test healthcare system by organising impromptu simulation sessions. Emergency Departments are however never quiet enough, even at night, for this to happen safely. Organising this for the team on call can prove to be difficult for the participants as well as patients because the session

could be very limited in time and the debriefing not optimal. The potential impact on the current workload and patient safety can become obstacles to impromptu in-situ simulation training (40) (54).

Simulation sessions are often non-compulsory and rely on volunteers from whom consent needs to be obtained especially if it is video recorded. It is preferable to offer such learning opportunity to a team finishing a shift by asking its members to stay longer rather than one about to start in order not to disrupt the patient handover. It has no effect on patient care, does not affect clinical rotas, and provides training time.

The simulation environment should correspond to the scenario and needs to be available for the session. It is always wise to plan for a second physical location in case a real patient occupies it. It requires facilitators to be adaptable. It is important to choose an appropriate location where to facilitate the debriefing. It should be close to the environment where the scenarios take place and be equipped with audio and video display equipment if necessary to allow for recording and/or remote observation (Figure 4). A local area network can be created to allow for communication between any patient care environment with any meeting room within the hospital. This would simplify the audio-visual system installation for in-situ training across the hospital.

Finally, what should one do from a moral and ethical point of view if a weakness in the system is discovered during an in-situ simulation session and that recommendations put forward are ignored despite the awareness that it is a potential patient safety issue? What is the responsibility of the simulation facilitators, of the participants, and of the management when they identify an issue compromising patient safety? Such are the challenges of in-situ simulation.

Despite some of the issues presented Miller et al. have recently proven that in-situ simulation improves teamwork and communication in trauma care (55). Theilen et al. showed that in-situ simulation improves emergency team response to deteriorating paediatric patients (56). In-situ simulation is gaining in popularity, but research in this domain is still very limited (4) (18). In-situ simulation allows the development of training programmes with a limited budget.

Figure 4: Example of the use of audio-video recording equipment during an in-situ scenario with a patient simulator.

3.3 Cost of simulation within a centre versus in-situ

High-fidelity simulation requires a significant financial investment because it requires a physical infrastructure, expensive equipment, and human resources to run the sessions for healthcare professionals.

Building a simulation centre can be an expensive investment and the return on investment will have to be demonstrated to senior administrators and management. To operate successfully it requires; spacious facilities adapted to receiving visitors; simulated clinical environments; control rooms; observation and debriefing rooms; audio-video recording and display equipment; more or less advanced patient simulators; and technical/administrative/educational/clinical staff. Simulation rooms are expensive to equip and not necessarily income generating. Such rooms often need to be multipurpose, making it difficult for them to reproduce a particular clinical setting.

For accessibility and clinical staff time saving considerations, it is recommended to build simulation centres at the proximity of hospitals. Their access should be built into educational programmes from an early stage in the training of future healthcare professionals. Their aim should be to help improve overall healthcare systems' performance. This performance could be publicly disseminated.

In a period of tight management of budgets, in-situ simulation can prove to be a very viable option. For example, Weinstock et al. developed a mobile simulation cart. It looks like a hospital trolley and incorporates all the equipment required to control their paediatric patient simulator. It helps provide high-fidelity simulation experiences at low cost. The operator computer is compatible with several patient simulators and enables the recording and debriefing of a session. Its cost is estimated at less than 10,000 dollars excluding the patient simulator (34) **(Table 2)**.

Equipment	Cost (USD)
Bi-directional media converter	$632.00
Media converter	$385.00
Laptop	$2,882.00
Video editing software	$285.00
High definition digital camcorder	$1852.00
Camera case	$29.00
High-grade tripod with fluid head and remote control	$349.00
Video light	$102.00
Stereo microphone	$90.00
LCD projector	$1,296.00
Portable audio monitor (for audio playback in large room)	$152.00
Total	**$8,054.00**

Table 2: Cost of the mobile simulation cart from Weinstock et al. (34)

This mobile simulation cart, like the one from Ikeyama et al., carries all the equipment required to run a simulation session of quality. It is an innovative educational tool as by providing an affordable solution it increases the accessibility of simulation-based training (57).

In contrast to Weinstock et al., Calhoun et al. estimates the cost of their simulation solution at 130,000 dollars but thinks that the real price to build a permanent centre may be three times higher. On top of this cost, for a permanent centre, maintenance and operational charges need to be added and considered as a recurring cost (34) (58).

CONCLUSIONS

In-situ simulation should not be seen as being inferior or a backwards approach in comparison to simulation taking place in permanently established centres. It is a way of making simulation more realistic to participants with potential benefits beyond the betterment of the participants. It is a sort of "back to the future" situation whereby training is returning to the point of care environment in a safe way, using actors or patient simulators rather than real patients.

Simulation might soon be too popular for its own good. Interprofessional collaboration naturally promotes the use of in-situ simulation. In the current economy where cuts happen at all levels, in-situ simulation may play an even greater role in ensuring quality of care as it may be the only viable training option for qualified healthcare professionals. The objective of in-situ high-fidelity simulation is to have a professional context within which human factors can be observed and discussed in order to improve patient care.

In-situ simulation brings together key factors such as being potentially very high-fidelity, it allows the acquisition of professional experience, it can drive improvements in patient care quality, and it may help keep training costs down. In-situ simulation may even be used for commissioning and accreditation purposes of healthcare systems and facilities. Innovating so as to promote the wider adoption of clinical simulation should be the priority of some research initiatives. It is nevertheless necessary to find a means of evaluating the real impact of such training approach within hospitals in terms of reduction of untoward incidents and health costs benefits.

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SIMULATION IN-SITU ET MILIEU PÉRILLEUX : COMMENT TESTER LES VOIES D'ACCÈS VASCULAIRES ?

In-situ simulation and wilderness medicine: how to test vascular access?

COUTRY L, HSSAIN I. Simulation in-situ et milieu périlleux : Comment tester les voies d'accès vasculaires ?. Med Emergency, MJEM 2013; 15: 29-37
Keywords: healthcare simulation, in-situ simulation, wilderness medicine, intra-osseous access.

ABSTRACT

Introduction: the International Registry in Organ Donation and Transplantation (IRODaT) seeks to support the transplant community by providing up-to-date data donation and transplantation worldwide. The database provides actualized and validated information provided by a network of professionals directly involved in the various stages of the donation and transplantation process. All collected data are available online, through IRODaT website www.irodat.org, so professionals may use them as descriptive and epidemiological reference. The registry provides statistics on actual deceased donors, donors after cardiac death and living donors, as well as on specific organ transplantation activities related to the three types of organ donation. All numbers are continuously checked, updated and validated and, when needed, responsible representatives are contacted for the required statistics.

Materials: data on organ donation and transplantation from 2011 and 2012 have been collected from 11 counties around the Mediterranean region.

Results: the information reveals remarkable differences between areas and type of donor, such as Croatia, Spain, Portugal, Slovenia and Italy have ones of the best rates in actual deceased donors in the world, and Turkey, Cyprus and Lebanon as well, but regarding rates on living donors. IRODaT provides data concerning the organ donation and transplantation activity for the general public and professionals around the world.

Conclusion: national and comparative generated on an international basis can be provided that is of extreme value to scientific programs and social and governmental bodies because they can support different initiatives of current practices in organ donation in any countries of the world.

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RÉSUMÉ

Introduction : La médecine d'urgence et la médecine en milieu périlleux se ressemblent par leurs difficultés de réalisation de certains gestes techniques, étant donné leur rareté ou bien leurs conditions de réalisation. La prise en charge d'une victime nécessite souvent la pose d'une voie veineuse afin de pouvoir entreprendre une thérapeutique. Suivant l'état clinique du patient ou bien en fonction du milieu dans lequel est arrivé l'accident, il faut agir rapidement et sûrement. La voie intra-osseuse est une alternative à la voie veineuse périphérique dite classique dans ces situations particulières. Mais est-elle souvent choisie ? Quelle est la performance des soignants lors de sa pose ? Quel est le ressenti des utilisateurs ?

Méthode : Cette étude propose à des sauveteurs en milieu périlleux de comparer, dans un environnement hostile comme la spéléologie ou le canyoning, la pose d'une voie intra-osseuse avec une voie veineuse périphérique sur simulateur. Ils doivent exprimer leur ressenti par rapport aux deux méthodes sur une échelle de Likert. Treize médecins en stage de médecine de montagne dans les Pyrénées françaises ont répondu au questionnaire.

Résultats : Il semble que la pose de la voie intra-osseuse est réalisée dans les mêmes délais que la voie veineuse périphérique mais que la voie intra-osseuse est ressentie plus rapide, plus facile et plus sûre et elle serait préférée en cas d'urgence en milieu périlleux.

Conclusion : La simulation in situ, en dehors des laboratoires, sur les lieux même d'exercice des professionnels de santé est un outil formidable pour tester l'organisation des soins ou une nouvelle technique, tout en évoluant dans un contexte d'apprentissage haute fidélité.

Mots clés : simulation en santé, simulation in-situ, milieu périlleux, voie intra-osseuse

Liste des abreviations : **VIO** : voie intra-osseuse; **VVP** : voie veineuse périphérique

I- INTRODUCTION

La simulation en santé est un outil intéressant qui permet d'exposer les apprenants à des situations cliniques complexes et variées sans risque pour le patient, recommandée depuis 2012 par l'HAS en France comme méthode d'apprentissage (1).

La simulation in-situ est une stratégie pédagogique originale, qui entraine les professionnels de santé dans leur environnement de travail habituel et permet l'analyse de l'organisation des soins en leur proposant une immersion dans le milieu réel d'exercice, rendant le transfert d'apprentissage proche du maximum (2).

Elle permet également de tester des nouvelles modalités de soin ou des nouveaux produits dans des conditions d'entrainement parfois irréalisables sauf en simulation. La médecine de montagne ou de milieu périlleux se prête tout à fait à l'application de la simulation in-situ (3).

Tout soignant apte à poser des voies d'accès vasculaires a pu connaitre des moments de grande difficulté pour obtenir un abord veineux efficace.

On retrouve parfois des délais de perfusion pouvant atteindre les 25 minutes en cas d'abord veineux difficile (4).

La VVP est la voie d'abord de premier choix en médecine d'urgence. Après une pose aseptique du trocart intraveineux, elle permet une absorption rapide et contrôlée du médicament avec un minimum de complication, pour un faible coût (5).

La VIO s'impose aujourd'hui comme étant la voie d'abord alternative lors de l'échec de la VVP.

L'études'est déroulée de façon comparative VIO/VVP lors d'un stage de spéléologie/canyoning afin de tester ces deux accès vasculaires en milieu dit périlleux.

1. MATERIEL ET METHODES

1.1 Rappels sur la voie intra-osseuse (VIO)

La VIO est la voie d'accès recommandée depuis 2005 en pédiatrie par l'American Heart Association (AHA) et l'European Ressuscitation Council (ERC) en première intention en cas d'arrêt cardio-respiratoire et de choc décompensé, surtout chez l'enfant de moins de 6 ans (6).

La VIO est aussi indiquée à tous les groupes d'âges après 2 échecs de mise en place d'une VVP ou si aucune voie d'accès n'est disponible dans les 90 secondes (6, 7, 8, 9).

Dans la réanimation cardiovasculaire enseignée dans l'« Advanced Cardiac Life Support », la VIO est indiquée avant la voie endotrachéale et après la voie intraveineuse (8).

Les protocoles de l'« Advanced Trauma Life Support » recommandent l'implantation de la VIO avant la pose d'une voie veineuse centrale (9).

Certains auteurs décrivent la VIO dans certaines circonstances comme pouvant être le premier choix chez l'adulte notamment la victime d'avalanche ou lors de situations impliquant de nombreuses victimes : attentat, situation NRBC… (10, 11).

1.2 Design de l'étude

Il s'agit d'une étude comparative non randomisée sur simulateur entre la pose de perfusion par VVP et la pose de perfusion par VIO avec le dispositif EZ-IO® en milieu périlleux : un site de pratique de la spéléologie «le gouffre de Bexanha » à 80 mètres de profondeur et un site de pratique du canyoning dans les PyrénéesEspagnoles « Foz de Fago» **figure 1 et 2**

Figure 1

Figure 2

L'analyse s'est portée sur le temps de pose d'une perfusion par VIO avec le dispositif EZ-IO® et le temps de pose d'une perfusion par VVP classique.

Le ressenti des pratiquants concernant le choix du mode d'accès vasculaire a été comparé par un questionnaire anonyme comprenant une échelle de Likert, notée de 1 à 5 (Annexe 2).

Cette méthode et le matériel utilisés sont largement inspirés de l'étude du CESU 68 portant sur la comparaison entre la pose de VIO et VVP en médecine d'urgence, réalisée en 2010 (12).

Successivement, 13 participants effectuent, dans un ordre aléatoire, la mise en place d'une VIO et d'une VVP en milieu périlleux :

En spéléologie **Figure 3**
En canyoning **Figure 4**


Figure 3

Figure 4

1.3. Matériel et méthodes de l'étude

La mise en place de la VVP s'effectue sur un bras de perfusion Laerdal® multi veines adultes qui permet la palpation, une désinfection du site de ponction choisi, une cathétérisation avec retour veineux réaliste sur les veines de la main, en radiale, en céphalique, en médiane et en basilique. **Figure 5**

Figure 5

La pose du cathéter veineux se fait dans les conditions les plus proches de la réalité clinique et selon les recommandations de l'HAS pour la prévention des infections liées aux cathéters veineux périphériques. Le matériel est présenté dans des emballages stériles (13).

Le participant est chronométré du lavage de mains à l'ouverture du débit, temps mesuré jusqu'à réussite objectivée par un reflux veineux dans la tubulure.

L'ensemble des étapes du protocole préétabli doit être réalisé pour valider le temps de pose. (Annexe 1)

Le participant est guidé par l'examinateur si nécessaire.

La mise en place de la VIO s'effectue sur un os tibial droit adulte Laerdal® avec un patch de peau qui permet la recherche des repères osseux, l'insertion à travers une peau synthétique dans la corticale puis dans le canal médullaire. **Figure 6**

Figure 6

L'EZ/IO® a été choisie pour la réalisation de l'étude parce c'est un matériel innovant permettant de s'affranchir de la contrainte d'épaisseur de corticale permettant son utilisation chez l'enfant et chez l'adulte (14).

La pose de la VIO se fait dans les conditions les plus proches de la réalité clinique, selon les recommandations de la Haute Autorité de Santé pour la prévention des infections liées aux cathéters veineux périphériques et selon les protocoles de pose utilisant l'EZ/IO® établi par le constructeur Vidacare. Le matériel est présenté dans des emballages stériles (13).

Le participant est chronométré du lavage des mains à l'ouverture du débit et mise sous pression de la poche de perfusion, temps mesuré jusqu'à réussite objectivée par la présence de liquides dans la médullaire.

L'ensemble des étapes du protocole préétabli doit être réalisé pour valider le temps de pose. (Annexe 1)

Le participant est guidé par l'examinateur si nécessaire.

A la fin des ateliers pratiques, les participants doivent remplir un questionnaire sur leur ressenti (Annexe 2) :

- d'une part, sur la pose de la VIO avec le système EZ-IO® en évaluant la facilité ou la difficulté de l'insertion en donnant une note de 1 à 5.

- d'autre part, sur la différence, définie de manière subjective, entre la VIO et la VVP au niveau de la facilité, de la rapidité, de la stabilité des 2 modes de perfusion et sur quel accès choisiraient-ils entre les deux en cas d'urgence vitale en milieu périlleux.

2. RESULTATS

2.1 LES PARTICIPANTS:

Les 13participants ont en moyenne 30 ans allant de 27 à 38 ans, 4 (30%) sont des femmes. Il y a 6 urgentistes, 3 internes,3 anesthésistes réanimateurs, 1 médecin généraliste.
Tous pratiquent la médecine d'urgence depuis au moins 1 an avec une moyenne de 3 ans.

Sur les 13 participants, 12 (92%) ont suivi une formation pratique sur la pose de VIO avant l'étude, 6 (46%) ont déjà posé une VIO dont 5 ont utilisé une perceuse EZ-IO® et 1 personne : le BIG (Bone Injection Gun).

Le médecin n'ayant pas bénéficié de formation pratique sur la VIO est anesthésiste-réanimateur, mais a déjà posé une VIO avec une aiguille de Cook.

2.2 LE RESSENTI DES PARTICIPANTS

2.2.1 Difficulté de pose de VIO par perceuse EZ-IO® en milieu périlleux:

Sur une note allant de 1 à 5, 1 étant « facile » et 5 « très difficile », 10 (76,0%) participants ont donné à la pose de VIO par perceuse EZ-IO® la note 1 et 3 (23,0%) la note 2.

2.2.2 Comparaison VIO – VPP en milieu périlleux

8 personnes (61%) ont trouvé la pose de VIO avec une perceuse EZ-® plus facile qu'une VVP, 5 (38%) n'ont pas vu de différence de difficulté.
8 personnes (61%) ont trouvé la VIO plus rapide que la VVP et 5 (38%) aussi rapide.
3 personnes (23%) ont trouvé la VIO plus sûre que la VVP, 7 (53,8%) aussi sûre et 3 (23%) moins sûre.
9 personnes (69,2%) répondent qu'en situation d'urgence vitale en milieu périlleux, ils utiliseraient d'emblée la VIO plutôt que la VVP et 4 (30,7%) répondent l'inverse.

2.3 TEMPS MOYENS DE POSE VIO/VVP

Voie d'abord	VIO	VVP
Temps en minutes	2,46	2,36

3. DISCUSSION :

3.1 Les participants :

Les 13 participants sont tous médecins et travaillant tous en médecine d'urgence.
Parmi les participants, 12 ont suivi une formation sur la pose de VIO avant l'étude.
Parmi les participants, 6 ont déjà posé une VIO dont 5 avec une EZ/IO®.
Le faible nombre des participants n'a pas permis de réaliser une étude statistique.
La moyenne d'âge jeune des participants (30 ans) peut s'avérer être un biais.

3.2 Les accès veineux

La pose d'une VVP est un acte de soin courant. On estime à 25 millions le nombre de cathéters posés par année. C'est le geste technique le plus courant pratiqué par les IDE exerçant en médecine d'urgence. La VVP est la voie d'abord de premier choix en médecine d'urgence. Après une pose aseptique du trocart intraveineux, elle permet une absorption rapide et contrôlée du médicament avec un minimum de complication, pour un faible coût (5).Les sites de ponction veineux sont les veines des mains et des bras, les veines de la jambe, les veines jugulaires externes (5, 15, 16).
Ce geste, à priori simple, peut s'avérer difficile dans certaines conditions. L'étude de Turkel décrit les difficultés pour trouver une VVP (17).
De plus, la pose d'une VVP n'est pas dénuée de risque pour le patient. Quelques études évoquent les risques d'infection en pré hospitalier (18, 19).

3.3 Les intérêts de la VIO en médecine pré hospitalière

La VIO permet un accès à un plexus de moelle veineux non contractile car sous tendu par des travées osseuses situé dans le tissu osseux spongieux, qui offre une voie rapide, sûre et fiable pour l'administration des médicaments, des cristalloïdes, des colloïdes et du sang (20, 21).

Cette route d'administration de médicament largement utilisée en pédiatrie était peu exploitée chez l'adulte, notamment du fait d'une corticale osseuse difficile à franchir. L'étude de Glaeser descriptive non randomisée, sur une période de cinq ans, avec 152 patients, utilisant l'aiguille de Jamshidi® en préhospitalier, retrouve un taux de réussite maximal chez l'enfant de moins de trois ans de 85%. Mais, chez l'adulte, le taux chute à 50% en raison d'une corticale trop épaisse (22).

Cependant, de récentes évolutions technologiques facilitent l'utilisation de la VIO chez l'adulte et permettent de s'affranchir de la contrainte d'épaisseur de corticale permettant son utilisation chez l'enfant et chez l'adulte (13).
Les différentes études comparatives ont montré un gain de temps significatif lors de la pose d'une VIO par rapport à une VVP et une VVC. Ce gain de temps permet dediminuer la morbi-mortalité (23, 24).

L'acquisition du geste technique nécessite un temps de formation théorique et pratique court(13).
Il n'y a qu'une seule contre indication absolue à la VIO: c'est la fracture de l'os en amont de la perfusion exposant au risque d'extravasation (25).
La complication la plus courante est l'extravasation autour du point d'insertion inhérente à un mauvais positionnement initial du trocart (26).
La complication majeure est l'ostéomyélite. Elle est retrouvée dans 1 % des 982 DIO de l'étude de Heinild (27). La méta-analyse de Rosetti porte sur 4200 cas d'enfant retrouve 0.6 % d'ostéomyélite, et seulement lorsque la perfusion intra-osseuse est prolongée sur une période inhabituelle ou lorsqu'une bactériémie existe au moment de lamise en place du dispositif (20).
La pose de VIO fait partie des actes médicaux (29).
Ce n'est actuellement pas un acte infirmier, en dehors du protocole préétabli spécifique à chaque établissement hospitalier (30).

3.4 La simulation in situ

La simulation haute fidélité est définie par le degré de réalité qu'atteint la séance de simulation. La simulation in-situ parvient à ce haut niveau de fidélité (ou réalité) car la séance se déroule à l'endroit même où les soins sont délivrés. En plus du simulateur et du décor, elle apporte un réalisme psychologique, c'est-à-dire la pression des facteurs humains avec notamment celle du temps et du stress et un contexte clinique proche du réel. Les scénarii tiennent compte de l'expérience et des préoccupations des professionnels de santé en se centrant sur des « exercices à base de problème ». Les adultes en formation apprennent mieux lorsque, ce qu'ils apprennent, pourra avoir une répercussion immédiate dans leur vie professionnelle (31).
La simulation in-situ a d'original qu'elle ne se développe pas au sein d'un centre de simulation mais peut être définie comme « la simulation au lit du malade » (« point of care ») c'est à dire que la séance se déroule au plus près de l'environnement clinique. Les équipes de Weinstock et Paige en sont les grandes promotrices (32) (33).
Il faut bien noter qu'elle n'est pas là pour remplacer la simulation faite dans un centre dédié mais vient plutôt compléter des objectifs de formation non atteignables en dehors d'un contexte de soin (34), comme par exemple un milieu périlleux.

3.5 Les milieux périlleux :

On pourrait définir comme milieu périlleux,les milieux naturels et artificiels extrêmement dangereux à cause du milieu en lui-même et à cause des techniques et du matériel spécifiques à chaque milieu.
La mer, la montagne, la spéléologie, les expéditions et les raids aventure sont des milieuxdifficilement prévisibles et dangereux.
En médecine d'urgence, l'intervention extra hospitalière, sur le bord de la route ou au domicile, est un milieu difficile du fait de condition de travail aléatoire.
En milieu périlleux se rajoute l'accès au patient qui demande des techniques, du matériel et un entrainement spécifiques pour les secours et un risque de sur-accident non négligeable.
En milieu souterrain se rajoute des facteurs d'agressions que sont l'obscurité,l'hypothermie, l'humidité, la ventilation de l'air, le risque d'accumulation des gaz, la topographie souterraine. Les eaux qui circulent dans les massifs calcaires ne sont pas filtrées. Il en résulte que même si elles sont limpides, elles sont en fait de véritable bouillon de culture augmentant les risques d'infections(35).
Le conditionnement médical du patient par le médecin se fait souvent seul sans aide paramédicale.
Le canadien Curran-Sills parle volontiers de médecine d'aventure. C'est la pratique de la médecine dans des environnements qui présentent l'un ou l'autre de ces facteurs: des conditions environnementales extrêmes ou incontrôlées; l'absence, l'insuffisance ou la rareté des ressources adéquates; des délais substantiels dans le transport ou l'arrivée des soins définitifs et demande aux praticiens de médecine d'aventure des habilités médicales, des habilités d'autres professionnels de la santé et des habilités non médicales(36).

La mortalité retrouvée dans l'étude de Bowie sur les accidents d'escalade au Parc Yosemite relève de traumatismes crâniens et d'hypothermies même si les accidents les plus fréquents sont des fractures des membres inférieurs. Toutes ces lésions nécessitent des voies d'abord vasculaire pour les traitements(37).
Montalvo retrouve dans les causes de décès des parcs nationaux américains : les pathologies d'origine cardiaque, les noyades et les chutes de grande hauteur (38).

L'étude de Pasquier sur les patients victimes d'avalanches dans les Alpes Suisses montre des situations médicales critiques, polytraumatismes, arrêt cardiorespiratoire hypoxémique ou sur hypothermie sévère, dont l'accès vasculaire est nécessaire mais rendu difficile par l'association entre état de choc et hypothermie avec vasoconstriction périphérique rendant la pose de VVP problématique (10).

L'analyse de 70 secours médicalisés en spéléologie par des équipes du SAMU 38 de 1975 à 2011 montre que la durée moyenne d'un secours spéléo est de 24 heures (de 1h33 à 8 jours et 10 h).Sur 119 victimes, 17 sont décédés, 9 noyées et les autres sont des traumatisés graves.24% des victimes étaient épuisés et en hypothermie.60 % des blessés ont bénéficié d'un abord veineux, 5.7 % ont bénéficié d'un réchauffement interne,36 % d'un remplissage. Un patient a été transfusé sous terre (3 culots pour fracture complexe du fémur) (35).
Souvent, la base du traitement est la pose d'une voie d'accès vasculaire.

3.6 Notre étude

Notre étude a étéréalisée dans 2 milieux hostiles différents : la spéléologie et le canyoning ; ce qui a permis de soumettre les participants aux difficultés techniques de mise en place d'accès vasculaire grâce à la simulation.
Aucune autreétude de simulation en milieu périlleux n'a été retrouvée.

Sunda étudié la VIO dans son service de secours par hélicoptère et considère que c'est un bon moyen pour la médecine d'urgence de terrain (39).
Ainsi, les travaux rétrospectifs sur la VIO en milieu périlleux confirment l'intérêt de cet abord vasculaire (10,40).

3.7 Le ressenti des participants :

3.7.1 Difficulté de pose de VIO par perceuse EZ-IO® :

Majoritairement, la mise en place de la VIO avec le système EZ-IO® est ressentie comme très facile.
Ce résultat est comparable aux résultats de l'étude du CESU 68 (13).
Les participants à l'étude de Schalk sont à 92% relativement des novices, avec moins de cinq poses de VIO avant l'étude, mais ont tous réussi à poser leur VIO (41).
Ceux de l'étude de Reads réussissent leur pose de VIO à 91% lors du premier essai et chez Leidel à 85% (42) (43).

3.7.2 La comparaison entre VIO et VVP :

La majorité des participants trouverait la pose de la VIO avec EZ-IO® plus facile, plus rapide et globalement aussi sûreque la pose de VVP, même les novices.
Les deux tiers des participants utiliseraient d'emblée la VIO par rapport à la VVP en cas de situation d'urgence vitale en milieu périlleux.
Il manque ici une étude qualitative afin de préciser les opinions des pratiquants et de les argumenter.
Le biais de recrutement pose là aussi un problème.

3.8 Temps moyen de pose de la VIO

Le temps moyen de pose est similaire à celui retrouvé par Leidel qui conclue que la VIO est une bonne voie d'accès en cas de VVP impossible (44).
Reads retrouve environ 4 minutes de temps moyen (42).

3.9 Différences entre les temps de pose VIO-VPP

L'étude révèle un temps moyen de pose de VIO/VVP presque équivalent.
Le nombre de manipulations est plus importantdans la préparation de la VIO.
Les participants sont des poseurs expérimentés en VVP.
Il existe depuis peu un nouveau conditionnement des VIO par EZ-IO® qui permet de réduire le nombre de manipulation grâce à des seringues pré-remplies permettant de réaliser les purges de tubulures et le flush de pression immédiatement.
Ce nouveau conditionnement devra être évalué sur le terrain.

II- CONCLUSIONS

La simulation in-situ est une méthode pédagogique qui se prête volontiers au milieu périlleux.
Elle est tout à fait adaptée pour tester la prise en charge d'une voie d'abord vasculaire difficile et peut mettre en évidence les points forts et les faiblesses d'une technique médicale comme la VIO, encore peu connue.

Ainsi, la pose de VIO semble réalisable en milieu périlleux, dans un délai compatible avec celui de la VVP et avec une très bonne acceptabilité des opérateurs, qui seraient prêts à l'utiliser en situation réelle.
Même si la VIO revient au premier plan dans l'exercice de la médecine d'urgence, son utilisation reste une alternative à la VVP, qui est la voie d'abord vasculaire de choix en médecine d'urgence et en milieu périlleux.
La simulation n'est qu'une « excuse » au debriefing, c'est-à-dire qu'elle permet d'ouvrir la discussion et d'analyser les pratiques professionnelles.

Afin de mieux évaluer les intérêts et les limites de chaque technique, il serait intéressant de reproduire l'étude sur un échantillon plus large d'utilisateurs, tout en sachant qu'organiser une séance de simulation in-situ en milieu périlleux est un exercice lui aussi périlleux (45).

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ANNEXE 1

Protocole: temps de réussite de mise en place d'une voie d'accès par VIO/VVP

ATELIER VVP :

1. Préparation :

- lavage des mains : début du chronomètre
- nettoie largement la zone à ponctionner au savon
- rince à l'eau
- sèche
- désinfection avec un antiseptique
- prépare la perfusion, tubulure purgée

temps intermédiaire :

2. insertion :

- met le garrot
- met des gants stériles
- repère la veine
- introduit le cathéter dans la veine
- jete l'aiguille dans le container
- connecte la perfusion purgée
- vérifie le retour veineux
- fixe le cathéter avec un pansement transparent
- règle le débit de perfusion : fin du chronomètre

Résultat VPP :

ATELIER VIO :

1. préparation :

- se lave les mains : début chronomètre
- Prépare 2 seringues de 10 ml
- Met des gants
- Localise le site d'insertion
- Désinfecte à l'aide d'une solution alcoolisée
- Purge le prolongateur EZ-connect avec 10 ml de Na cl 0.9%
- Prépare la perfusion, tubulure purgée et mise sous manchette à pression

Temps intermédiaire :

2. Insertion :

- Connecte aiguille au moteur
- Transperce la peau avec l'aiguille, actionne gâchette jusqu'au passage corticale et perte de résistance
- Ote le mandrin en le dévissant
- Connecte l'EZ-connect
- Flush avec 10 ml Na Cl 0.9%
- Commence perfusion sous pression (300 mm hg) : fin du chronométre

Résultat VIO :

ANNEXE 2

Questionnaire :

1. Votre statut :

☐ Etudiant IDE	☐ Anesthésiste/réanimateur	☐ IADE	☐ Anesthésiste/réanimateur
☐ IDE	☐ Autres spé (à préciser)	☐ Urgentiste	☐ Autres spé (à préciser)

2. Age :

3. Sexe :

☐ Homme ☐ Femme

4. Dans quel service travaillez-vous ?

5. Nombres d'années d'expériences professionnelles en médecine d'urgence ? :

6. Avant cette étude sur la VIO :

Avez-vous déjà bénéficié d'une formation sur la pose de VIO ?	☐ Oui	☐ Non
Avez-vous déjà posé une VIO ?	☐ Oui	☐ Non
Si oui : avez-vous utilisé une perceuse EZ-IO ?	☐ Oui	☐ Non

Si non : quel type de matériel avez-vous utilisé ?

7. comment trouvez-vous la pose de VIO avec perceuse EZ-IO? :
Donner une note de 1 à 5 : 1 : très facile à 5 : très difficile
Selon vous,

8. est-il plus facile, pareil, plus difficile, de poser une VIO qu'une VVP ?

9. est-il plus rapide, pareil, plus lent, de poser une VIO qu'une VVP ?

10. l'accès par VIO est-il plus sûr, pareil, moins sûr que l'accès par VVP

11. D'après vous, en situation d'urgence vitale, en milieu périlleu, utiliseriez-vous d'emblée la VIO plutôt que la VVP ?

ACCIDENT VASCULAIRE CEREBRAL DU A UN SYNDROME DE MOYAMOYA.
Stroke related to a Moyamoya syndrome.

REZGUI M, MAGHRAOUI H, YAHYA Y, ELHECHMI Y Z, JERBI Z. Accident vasculaire cerebrale du a un syndrome de Moyamoya. Med Emergency, MJEM 2013; 15: 38-40
Mots clés : Maladie Moyamoya, Accident Vasculaire Cérébral Hémorragique, Sténose artères cérébrales, polygone de Willis.
Keywords: Moyamoya Disease, Stroke Hemorrhagic-Stenosis-Cerebral arteries, Circle of Willis.

ABSTRACT

Introduction: Moyamoya disease is a rare disorder characterized by progressive Stenosis of the circle of Willis, with development of collateral circulation giving an appearance in «cigarette smoke», "Moyamoya" in Japanese and that results in ischemic stroke and/or hemorrhagic.

Observation: We reported the case of a 51 years old patient with a history of hypertension, brought by her family for a loss of consciousness with loss concept of urine. Clinical examination emergency found a conscious patient with a GCS 15/15, right hemiplegic, ipsilateral facial paralysis, aphasia and right Babinski sign. Brain computed tomography (CT) showed a hemorrhagic stroke in the left middle cerebral artery territory. The magnetic resonance angiography (MRA) objective bilateral occlusion of the middle cerebral artery origin of the left and right without network visualization of substitution with left lenticular hematoma, we completed the exploration by cerebral angiography that showed the network substitution of Moyamoya disease. We discuss the incidence, etiologic characteristics, clinical presentation and management of this entity in emergency department.

Conclusion: Moyamoya disease should be considered in any ischemic or hemorrhagic stroke in young adults, and should lead to angiographic abnormalities investigations to confirm the diagnosis and lead treatment.

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RÉSUMÉ

Introduction : La maladie de Moyamoya est une pathologie rare caractérisée par une sténose progressive du polygone de Willis avec développement d'une circulation collatérale. Ceci donne au scanner injecté un aspect en «volutes de fumées» ou «Moyamoya» en japonais et ayant pour conséquence des accidents vasculaires ischémiques et/ou hémorragiques.

Observation : Nous rapportons l'observation d'une patiente âgée de 51 ans, aux antécédents d'hypertension artérielle, amenée par sa famille pour une perte de connaissance avec notion de perte des urines. L'examen clinique aux urgences trouve une patiente consciente avec un score de Glasgow égal à 15, une hémiplégie droite, une paralysie faciale homolatérale, une aphasie et un signe de Babinski à droite. La tomodensitométrie cérébrale (TDM) montre un accident vasculaire hémorragique dans le territoire sylvien gauche. L'Angio-IRM objective une occlusion bilatérale de l'origine des artères cérébrales moyennes droite et gauche sans visualisation de réseau de suppléance avec hématome lenticulaire gauche. L'artériographie cérébrale met en évidence un réseau de suppléance posant le diagnostic de maladie de Moyamoya. Notre travail propose de discuter l'incidence, les caractéristiques étiopathogéniques, cliniques et la prise en charge thérapeutique aux urgences de cette entité.

Conclusion : Même si elle n'est pas la cause première d'accident vasculaire cérébral hémorragique chez l'adulte jeune, la maladie de Moyamoya doit être évoquée devant tout accident vasculaire cérébral d'origine ischémique ou hémorragique dans cette population, et doit faire rechercher des anomalies artériographiques pour confirmer le diagnostic et optimiser le traitement.

INTRODUCTION

La maladie de Moyamoya est une maladie angiogénique cérébrale liée à une sténose progressive du polygone de Willis, avec développement d'un réseau collatéral qui donne un aspect en «fumée de cigarette» ou «Moyamoya» en japonais. Elle a pour conséquence des accidents ischémiques et/ou hémorragiques nécessitant un diagnostic précoce pour un traitement spécifique rapide(1).

CAS CLINIQUE

Nous rapportons l'observation d'une patiente âgée de 51 ans, aux antécédents d'hypertension artérielle depuis huit ans actuellement bien équilibrée. Elle est amenée par sa famille aux urgences pour une perte de connaissance avec notion de perte des urines. L'examen clinique trouve une patiente consciente avec un score de Glasgow égal à 15, une hémiplégie droite, une paralysie faciale homolatérale, une aphasie et un signe de Babinski à droite. La pression artérielle est à 140/80 mmHg, le pouls à 88 bpm, la glycémie capillaire à 1,8 g/L.Le bilan biologiquemontre une rabdomyolyse avec des créatinines phospho-kinase (CPK) à 2200 UI/L. La tomodensitométrie cérébrale avec injection de contraste (angio-TDM) réalisée en urgence retrouve un accident vasculaire hémorragique dans le territoire sylvien gauche avec un effet de masse sur le ventricule homolatéral sans déviation de la ligne médiane **(figure 1)**. Devant le jeune âge de la patiente, une angiographie par raisonance magnetique (angio-IRM)est réalisée rapidement permettant d'objectiver une occlusion bilatérale de l'origine des artères cérébrales moyennes droite et gauche sans visualisation de réseau de suppléance avec un hématome lenticulaire gauche **(figure 2 et 3)**. L'angiographie cérébrale effectuée à la demande des neurologues confirme le diagnostic de maladie de Moyamoya par la présence d'une occlusion bilatérale à l'origine des deux artères cérébrales moyennes avec développement d'un réseau anastomotique de suppléance **(figure 4)**. L'électroencéphalogramme montre un tracé comitial. Un traitement symptomatique est initialement mis en place consistant à uneéquilibration de la pression artérielle et des troubles hydro électrolytique associé à un traitement anticomitial et une rééducation motrice et orthophonique. Le traitement chirurgical proposé a été refusé par la patiente.

A l'issue de la première année d'évolution, la patiente est mise sous traitement antiagrégant plaquettaire après résorption de l'hématome.Deux ans après l'évènement aigu, la patiente présente une récupération sur le plan moteur mais garde des troubles du langage.

DISCUSSION

La maladie de Moyamoya est rare, sa prévalence est de l'ordre de 1/32000 dans la population japonaise, elle intéresse surtout les enfants (1,2). En Europe et en Amérique du nord, elle est encore dix fois moins fréquente, soit 1/320000 habitants et intéresse l'adulte jeune. Cette maladie touche donc principalement les enfants entre 5 et 15 ans et l'adulte entre 30 et 50 ans, avec une prédominance féminine.

La physiopathologie de la maladie de Moyamoya est mal connue. Elle serait liée à une artériopathie chronique idiopathique, avec épaississement progressif de la paroi des artères cérébrales, préférentiellement de la base du crâne, qui entraine une ischémie d'aval. L'ischémie stimule la production de facteurs angiogéniques responsables du développement de néo-vaisseaux de suppléance. Cette néo-vascularisation est pourvoyeuse de sténose ou de ruptures de type micro-anévrysmales pouvant entraîner des accidents vasculaires cérébraux à répétition de nature ischémique ou hémorragique particulièrement chez l'adulte (1;3). L'étiopathogénie de cette maladie reste inconnue. Elle peut être primitive ou secondaire à une tumeur traitée par radiothérapie, à une drépanocytose, à la trisomie 21 ou associée à une neurofibromatose de type I. Des formes familiales, héréditaires, de transmission autosomique récessive ont été décrites dans environ 10% des cas (1;4). Dans notre cas la patiente était hypertendue et les explorations angiographiques ont permis d'évoquer le mécanisme thrombotique probablement par occlusion bilatérale des artères cérébrales moyennes. La néo-vascularisation visualisée à l'angiographie a permis d'expliquer la complication hémorragique.

Le tableau initial de notre patiente associant convulsions et déficit moteur de l'hémicorps droit peut aussi associer communément des troubles du langage, de la vision et de la coordination.

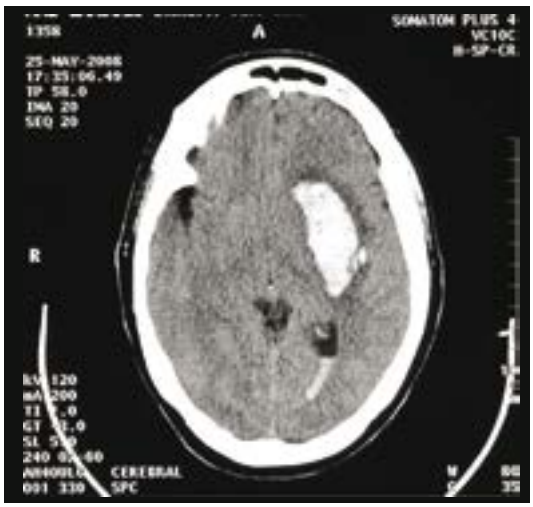

Figure 1

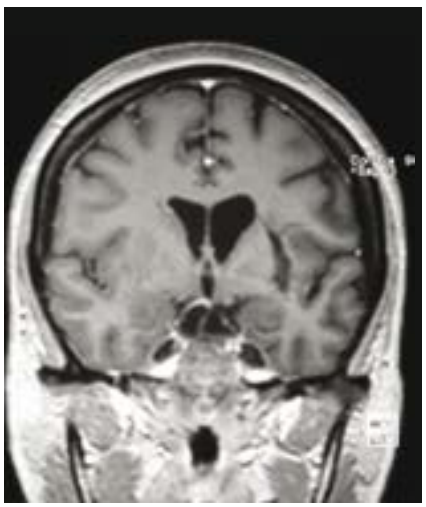
Figure 2

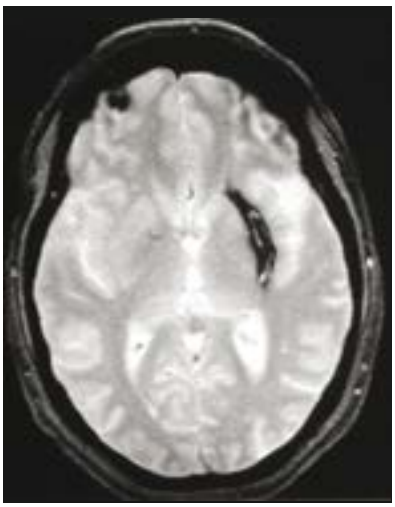
Figure 3

Des signes cliniques à type de faiblesse musculaire, de paralysie ou de troubles de la sensibilité sont parfois associés à des crises convulsives ou des troubles psychiques (2). Ces manifestations aussi incomplètes soient-elles, doivent immédiatement indiquer la réalisation d'explorations tomodensitométriques. Ceci interroge sur l'importance d'une régulation pré-hospitalière de ce type de tableau cliniquedirectement dans une structure hospitalière validée dans la prise en charge des urgences neuro-vasculaires. Ce type de procédure n'est pas encore généralisé dans de nombreux pays.

Le diagnostic radiologique chez notre malade est fait devant la présence d'une occlusion bilatérale à l'origine des deux artères cérébrales moyennes avec développement d'un réseau anastomotique de suppléance évoquant la maladie de Moyamoya, confirmé par l'angiographie. Ce diagnostic peut être évoqué sur l'angio-TDM cérébrale et l'IRM objectivant la présence d'accidents ischémiques multiples d'âges différents, d'éventuelles hémorragies et de vaisseaux anormaux de la base, l'angiographie cérébrale est le seul examen qui confirme le diagnostic (5-7).

Le traitement médical chez notre patiente a était symptomatique. L'efficacité du traitement médical associant un antiagrégant plaquettaire et vasodilatateur artériel n'est pas clairement prouvée. L'indication opératoire n'a pu être été retenue chez notre patiente en raison de la découvertetardive de la maladie mais surtout du refus de celle-ci. Le traitement de la maladie de Moyamoya est principalement chirurgical dans les formes de découverte précoce (7-9). Cela doit encourager à démarrer les explorations spécifiques rapidement.

L'évolution chez notre malade a été favorable avec une récupération motrice complète mais persistance de troubles du langage et de manifestations psychiques à type d'inhibition.

Figure 4

Dans la littérature, l'évolution spontanée peut être insidieuse avec céphalées, crises épileptiques, détérioration du langage et des fonctions cérébrales supérieures. La mortalité est de l'ordre de 10% chez l'adulte et de 4% chez l'enfant (1,3,10).

CONCLUSION

Nous rapportons une cause rare d'accident vasculaire cérébral hémorragique chez l'adulte jeune et nous soulignons l'importance d'un diagnostic précoce de la maladie de Moyamoya afin de proposer rapidement une revascularisation chirurgicale. La prise en charge de ce type d'AVC implique idéalement une régulation pré-hospitalière précoce sur une structure d'urgences neuro-vasculaire à même de réaliser un diagnostic et un traitement optimal et améliorer le pronostic de ces jeunes patients.

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TESTEZ VOS CONNAISSANCES EN TOXICOLOGIE
INTOXICATION PAR LES BÊTABLOQUANTS : QUELLE PRISE EN CHARGE ?
Management of beta-blocker poisoning

MÉGARBANE B. Intoxication par les bêtabloquants : quelle prise en charge ? Med Emergency, MJEM 2013; 15: 41-45
Mots clés : intoxication; bêtabloquant; choc; antidote.
Keywords: poisoning; beta-blocker; circulatory failure; antidote.

ABSTRACT

Beta-blockers are responsible for the most frequent poisonings among cardiotoxicants. Clinical presentation includes at least sinusal bradycardia. Acute cardiovascular failure with cardiac impairment is possible mainly if involving a beta-blocker with stabilizing membrane activity. Blood lactate concentrations are normal, even in the presence of shock requiring the identification of organ dysfunction to assess the prognosis. Several molecules have been reported as efficient antidotes to improve hemodynamics, including dobutamine, isoprenaline, epinephrine, glucagon, and insulin. In case of refractoriness to conventional pharmacological treatments, lipid emulsions could be infused and extracorporeal life support set up to be life-saving.

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RÉSUMÉ

Les intoxications par bêtabloquants sont les plus fréquentes des intoxications par cardiotoxiques. Le tableau clinique comporte au minimum une bradycardie sinusale. Une insuffisance circulatoire avec dysfonction cardiaque est possible, notamment en cas de bêtabloquant avec effet stabilisant de membrane. Les lactates sont souvent normaux même en présence d'un choc et le diagnostic de gravité impose de rechercher une dysfonction d'organe. Plusieurs molécules ont été décrites comme antidote efficace pour améliorer le tableau hémodynamique : la dobutamine, l'isoprénaline, l'adrénaline, le glucagon et l'insuline. Dans les situations réfractaires aux traitements pharmacologiques conventionnels, on peut recourir aux émulsions lipidiques et poser l'indication d'une assistance circulatoire veino-artérielle.

Cas clinique:

Une jeune femme de 35 ans, dépressive à la suite de la mort de son enfant in utero il y a environ un an est admise aux urgences pour l'ingestion de 6 g de propranolol (Avlocardyl LP®), traitement prescrit depuis trois ans par son médecin traitant pour une migraine invalidante.

A l'admission, 4 heures après la prise en charge, la patiente est parfaitement consciente, bradycarde à 40 /min et présente une hypotension artérielle à 80/55 mmHg, sans marbrures ni autre anomalie à l'examen clinique. L'ECG retrouve un bloc de conduction auriculoventriculaire de 1e degré (espace PR de 24 ms), un élargissement des QRS (125 ms) ainsi qu'un aplatissement diffus des ondes T. La créatininémie est à 135 μmom/L, sans autres anomalies ioniques.

La mesure des lactates sanguins montre une valeur de 1,2 mmol/L (N, 1-2).

Après l'injection de 0,5 mg d'atropine, la fréquence cardiaque reste inchangée. Une perfusion de sérum salé isotonique est alors débutée en débit libre. La patiente est transférée en réanimation, pour une prise en charge spécialisée.

QCM1 – Parmi les propriétés pharmacodynamiques suivantes, lesquelles sont attribuables aux bêtabloquants :

A- Les bêtabloquants sont des agonistes sélectifs des récepteurs bêta-adrénergiques
B- Les bêtabloquants exercent des propriétés bathmotropes négatives
C- Le sotalol peut être responsable d'un allongement de l'espace QT sur l'ECG
D- Le labétalol est doté de propriété alpha-bloquante
E- Le propranolol peut induire un effet stabilisant de membrane

QCM2 – Quelles sont les conséquences cliniques d'une intoxication par bêtabloquant ?

A- Un état de choc avec atteinte cardiaque directe
B- Une élévation significative des lactates, comme marqueur de cet état de choc
C- Une insuffisance rénale aiguë
D- Une crise convulsive
E- Une hypersécrétion bronchique

QCM3 – Parmi les anomalies suivantes, lesquelles peuvent être observées au décours d'une intoxication par le propranolol ?

A- Une bradycardie sinusale
B- Un bloc auriculo-ventriculaire de 3e degré
C- Un élargissement significatif des QRS
D- Un syndrome de Brugada
E- Une tachycardie ventriculaire

QCM4 – Parmi les points suivants, lesquels sont associés à un risque évolutif plus péjoratif ?

A- Présence d'un coma
B- Elargissement des QRS sur l'ECG
C- Absence d'élévation des lactates sanguins
D- Elévation des transaminases
E- Co-ingestion d'un autre cardiotoxique

QCM5 – Quelles mesures doivent être mises en route à partir du service d'urgence chez un sujet admis pour une ingestion d'une dose excessive de bêtabloquants, 1 heure auparavant ?

A- Transfert en réanimation
B- Administration d'une dose de charbon activé
C- Administration de bicarbonates isotoniques en cas d'élargissement des QRS
D- Diurèse osmotique alcaline
E- Hémodialyse en urgence

QCM6 – Dans la liste suivante, quelles molécules seraient utiles comme traitement des intoxications par bêtabloquants ?

A- Dobutamine
B- Isoprénaline
C- Glucagon
D- Insuline
E- Une émulsion lipidique (Intralipide®)

QCM7 – Parmi les affirmations suivantes concernant la prise en charge thérapeutique des intoxications graves aux bêtabloquants en réanimation, lesquelles sont exactes ?

A- L'adrénaline est la catécholamine de recours en cas de choc ne répondant pas à la dobutamine.
B- Les inhibiteurs des phosphodiestérases sont faciles à administrer et sont prescrits d'emblée.
C- La place du lévosimendan reste encore hypothétique.
D- L'entraînement électrosystolique est le traitement de référence du bloc de conduction auriculoventriculaire de haut degré associé à une dysfonction cardiaque.
E- L'ECMO veino-veineuse est une technique d'assistance circulatoire à laquelle il faut recourir en présence d'un choc cardiogénique réfractaire.

Réponses aux QCM :
1-C,D,E ; 2-A,C,D ; 3-A,B,C,D,E ; 4-B,D,E ; 5-A,B ; 6-A,B,C,D,E ; 7-A,C

Commentaires :

Les bêtabloquants représentent la classe à l'origine du plus grand nombre d'intoxications par cardiotropes. La fréquence de ces intoxications augmente, en raison de prescriptions croissantes, non seulement pour des pathologies cardiovasculaires (hypertension artérielle, angor, syndrome coronarien, tachyarythmie ventriculaire ou supraventriculaire, insuffisance cardiaque) mais aussi pour des pathologies non cardiaques (glaucome, anxiété, tremblements, migraine, phéochromocytome).

QCM1 - Les bêtabloquants sont des antagonistes compétitifs des catécholamines endogènes au niveau des récepteurs bêta-adrénergiques. Ils appartiennent à la classe 2 de Vaughan-Williams et inhibent l'entrée de Na+ et Ca2+ à la phase 0 du potentiel d'action et ont une action sur la contractilité par l'inhibition de libération du Ca2+ à partir du réticulum sarcoplasmique **(Tableau 1).** Ils exercent des propriétés chronotrope négative (diminution de la fréquence cardiaque de repos et à l'effort), inotrope négative (baisse de la contractilité), dromotrope négative (blocage de la conduction nodale) et bathmotrope négative (baisse de l'automatisme et de l'excitabilité, sinusale et auriculo-ventriculaire). Au sein de cette classe, le solatolol possède des propriétés de classe 3 et le labétolol présente une activité alpha-bloquante additionnelle. Le sotalol est responsable d'une augmentation de la durée du potentiel d'action et de la période réfractaire, responsables d'un allongement de la repolarisation et donc de l'espace QT sur l'ECG. Plusieurs bêtabloquants peuvent aussi inhiber à doses toxiques le canal sodique : c'est le cas du propranolol, de l'acébutolol, du nadoxolol, du pindolol, du penbutolol, du labétalol, du métoprolol, et de l'oxprénolol. Ces molécules sont à l'origine d'une surmortalité en comparaison aux molécules dépourvues d'effet stabilisant de membrane. En terme pharmacocinétique, la résorption digestive

Tableau I – Propriétés pharmacologiques des principaux bêtabloquants
ASI : activité sympathomimétique intrinsèque ; ESM : effet stabilisant de membrane ; Elimination prédominante hépatique (H) ou rénale (R)

Nom	Cardio-sélectivité	ASI	ESM	Elimination
Acébutolol	+	+	+	H et R
Aténolol	++	0	-	R
Bisoprolol	+++	0	-	R
Céliprolol	+	+	-	H et R
Labétolol	0	0	+	H et R
Métoprolol	+	0	+	H
Nadolol	0	0	-	R
Propanolol	0	0	+	H
Sotalol	0	0	-	R

des bêtabloquants est plutôt rapide, les métabolites produits par le foie généralement actifs et l'élimination partiellement rénale.

QCM2 - Les principales manifestations faisant suite à une intoxication par bêtabloquant sont l'hypotension, la bradycardie et le bloc de conduction auriculo-ventriculaire. Le tableau clinique peut se résumer parfois à une bradycardie isolée (sans gravité en l'absence d'insuffisance cardiaque préexistante ou de prise de sotalol) ou à une hypotension artérielle modérée sans hypoperfusion tissulaire associée. Les formes sévères surviennent dans environ 20% des cas et se caractérisent par un collapsus ou un état de choc avec bradycardie inadaptée. Elles se rencontrent principalement avec les bêtabloquants à effet stabilisant de membrane, comme pour notre patiente, et peuvent conduire à un arrêt cardiaque. La survenue d'une insuffisance circulatoire impose un monitorage hémodynamique, comprenant notamment une échocardiographie. Ce bilan hémodynamique permet d'évaluer la volémie et de différencier les chocs à résistances vasculaires élevées (défaillance cardiaque) de ceux moins fréquents à résistances basses (vasoplégie). Le choc cardiogénique induit par les bêtabloquants peut survenir même quand le rythme cardiaque est d'origine sinusale.

Le risque d'œdème pulmonaire est modéré en l'absence d'arrêt circulatoire, en raison de la défaillance bi-ventriculaire. Un trouble de vigilance traduit généralement une diminution de la perfusion cérébrale secondaire au choc. Des convulsions ont été rapportées, essentiellement avec le propranolol en raison de sa liposolubilité et des effets stabilisants de membrane. Une dépression respiratoire d'origine centrale est aussi possible dans les cas graves, notamment avec les molécules lipophiles et semble potentialisée par l'éthanol. La survenue d'un bronchospasme est rare et réservée aux sujets prédisposés. L'insuffisance hépatique aiguë survient préférentiellement dans les suites d'une insuffisance circulatoire prolongée (« foie de choc »). L'ischémie mésentérique, les anomalies glycémiques ou l'hyperkaliémie sont également rares (<1%), alors que l'hypokaliémie, secondaire au transfert intracellulaire de potassium, est possible en cas d'effet stabilisant de membrane. Un risque d'hypoglycémie a été décrit chez le nourrisson lors d'intoxications accidentelles.

La particularité des intoxications par bêtabloquants est de ne pas induire une élévation des lactates, du moins telle qu'aurait pu le laisser envisager la défaillance circulatoire associée. L'hyperlactatémie n'est donc pas un marqueur du choc induit par les bêtabloquants. Il faut rechercher les signes directs de dysfonction d'organe : baisse de la diurèse et de la clairance rénale, trouble de vigilance, cytolyse hépatique, anomalies de l'hémostase, …

QCM3 - Les anomalies ECG vont de la bradycardie sinusale au bloc sino-auriculaire de haut degré, du bloc auriculo-ventriculaire de premier degré le plus souvent (élargissement isolé de l'espace PR) au bloc de troisième degré, des arythmies de type jonctionnel aux arythmies ventriculaires (propranolol) ou torsades de pointe (sotalol). Un élargissement des complexes QRS peut être révélateur d'un rythme ventriculaire d'échappement infra-hissien ou d'un effet stabilisant de membrane (traduisant un bloc de conduction intra-ventriculaire). Sy associe alors un aplatissement des ondes T et allongement modéré de l'espace QT corrigé en fonction de la fréquence. Des aspects de syndrome de Brugada et de syndrome coronarien aigu avec élévation du segment ST (par vasospasme coronarien et angor de Prinzmetal) ont été décrits. Le sotalol peut provoquer une bradycardie à QRS fins et à QT allongé, exposant alors au risque de torsades de pointe. Dans ces intoxications, la bradycardie n'est donc pas un signe de bénignité, car elle expose au risque d'arythmie pouvant mettre en jeu le pronostic vital.

QCM4 – LA présence d'ne cardiopathie sous-jacente conditionne le pronostic. L'intoxication par bêtabloquant est mono-médicamenteuse dans 20% des cas ; mais la co-ingestion d'un second cardiotrope peut aggraver le pronostic. Les deux facteurs prédictifs de morbidité cardiovasculaire retrouvés en analyse multivariée dans une étude prospective incluant 280 cas d'exposition aux bêtabloquants déclarés aux centres antipoison américains étaient la co-ingestion d'un médicament cardiotoxique et l'effet stabilisant de membrane du bêtabloquant ingéré. L'intérêt du dosage sanguin en urgence des bêtabloquants reste discuté.

Dans une étude cas-contrôle américaine, le lactate veineux mesuré aux urgences était retrouvé comme élément pronostique en cas d'intoxication aiguë, avec un seuil de 3 mmol/l permettant de discriminer les survivants des décédés (sensibilité 84% et spécificité 75%). Dans une étude rétrospective conduite dans notre service de réanimation à Paris et portant sur 110 intoxications par bêtabloquant, le lactate artériel mesuré à l'admission était aussi significativement différent entre patients survivants et patients décédés (1,6 mmol/l versus 3,1 mmol/l respectivement ; p<0,0001). Cependant, quatre patients parmi les neuf décédés dans cette étude avaient une lactatémie < 3 mmol/l. Ainsi, le seuil de lactate permettant de distinguer les patients survivants des décédés semble plus bas que 3 mmol/l dans les intoxications par bêtabloquants. Les autres paramètres significativement qui différaient dans cette étude selon le devenir final, étaient la créatininémie, les bicarbonates, le taux de prothrombine, les transaminases, le rapport

PaO2/FiO2 et l'existence d'un élargissement des QRS à l'ECG.

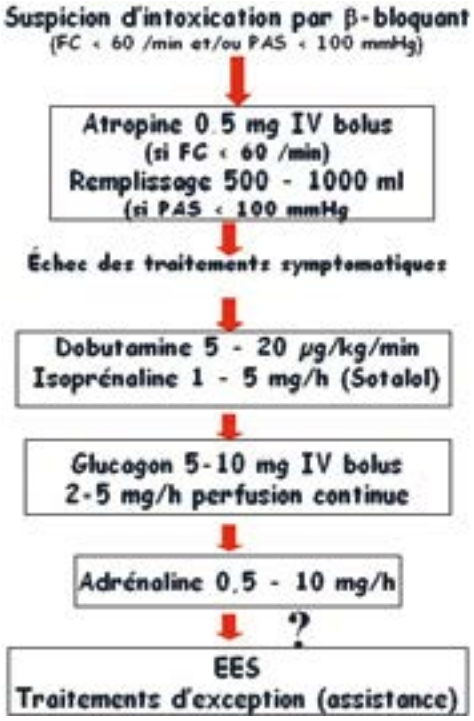
QCM5 - En pratique, toute exposition symptomatique à un bétabloquant justifie une surveillance médicalisée et un transfert en réanimation. Pour faciliter la prise en charge pré-hospitalière, des recommandations ont été proposées concernant la dose ingérée minimale imposant une hospitalisation rapide chez l'adulte : 240 mg pour le propranolol, 600 mg pour l'acébutolol, 200 mg pour l'aténolol, 50 mg pour le carvédilol, 400 mg pour le labétalol, 400 mg pour le métoprolol (450 mg si libération prolongée) et 160 mg pour le sotalol. La dose-seuil de toxicité chez l'adulte (plus petite dose ayant entraîné une toxicité rapportée dans la littérature) est également variable selon le bêtabloquant considéré : 800 mg pour le propranolol, 4000 mg pour l'acébutolol, 500 mg pour l'aténolol, 1050 mg pour le carvédilol, 6000 mg pour le labétalol, 7500 mg pour le métoprolol et 560 mg pour le sotalol.

La décontamination digestive doit être réalisée, en l'absence de contre-indications, dans les deux heures suivant l'ingestion. Elle ne doit jamais faire retarder les mesures symptomatiques ou antidotiques, seules capables d'améliorer le pronostic. Le charbon activé est préférable au lavage gastrique, les bétabloquants étant bien adsorbés par le charbon. Cependant, aucune étude n'a démontré l'intérêt de la décontamination digestive pour réduire la toxicité. Son intérêt en cas d'ingestion de comprimés à libération prolongée reste possible mais également à évaluer.

La diurèse osmotique et les méthodes d'épuration extra-rénale sont peu utiles, du fait du large volume de distribution des bétabloquants, des clairances corporelles totales élevées et de leur liaison le plus souvent élevée aux protéines plasmatiques. Quelques cas cliniques d'évolution favorable sous hémodiafiltration ont été rapportés lors d'intoxications massives avec insuffisance rénale.

A l'inverse, la correction des désordres associés (métabolique, ionique et acido-basique, d'hypothermie ou d'hypoxie) est essentielle. La ventilation mécanique doit être discutée voire réalisée rapidement, parallèlement au traitement pharmacologique, lors d'intoxications sévères caractérisées par un collapsus et des QRS élargis, une détresse respiratoire ou une apnée centrale. L'hypoxémie et l'acidose respiratoire potentialisent la toxicité des bétabloquants et réduisent l'efficacité des catécholamines. Les autres indications de la ventilation sont le bronchospasme sévère, les convulsions ou le coma, parallèlement à une prise en charge hémodynamique efficace dans ce dernier cas. Les bicarbonates molaires de sodium sont recommandés en cas d'effet stabilisant de membrane (perfusion de 250 ml à 84‰ avec 2 g de KCl, renouvelable si besoin).

Figure 1 – Schéma de traitement des intoxications par bêtabloquants



FC : fréquence cardiaque ; PAS : pression artérielle systolique ; EES : entraînement électrosystolique

QCM6 – L'atropine (0,5 à 1 mg) peut être administrée chez tout patient bradycarde. Elle réactive l'adénylate cyclase en s'opposant à l'action inhibitrice de l'acétylcholine ; mais en cas de blocage adrénergique complet, elle est incapable de provoquer l'accélération du cœur Ainsi, la correction d'une bradycardie par une dose unique d'atropine rend le diagnostic d'intoxication grave par bétabloquants peu probable (test diagnostique permettant de différencier la part d'hypertonie vagale du réel bêta-blocage).

Le traitement de l'hypotension artérielle débute par un remplissage vasculaire **(Figure 1).** Les catécholamines bêta-agonistes s'opposent de façon compétitive aux bétabloquants au niveau des récepteurs et finissent le plus souvent par être efficaces à condition d'administrer des doses suffisantes, parfois très supérieures aux doses thérapeutiques usuelles. La dobutamine est la molécule utilisée de 1e intention. L'isoprénaline est préférée en cas d'intoxication au sotalol, même en présence d'une bradycardie isolée sans hypotension, afin de prévenir le risque de torsade de pointes. Cependant, le risque d'hypokaliémie et l'effet vasodilatateur bêta-1 puissant de l'isoprénaline peuvent en limiter l'efficacité et rendre nécessaire l'adjonction d'un agent vasoconstricteur (noradrénaline).

Le glucagon est l'antidote de seconde ligne des intoxications par bétabloquants, même si aucune étude clinique randomisée n'en a formellement établi l'intérêt. Il agit en court-circuitant la liaison du bêtabloquant à son récepteur : il active l'adénylate cyclase membranaire via un récepteur indépendant de celui des catécholamines et augmente l'AMP cyclique intracellulaire. Son action inotrope positive ne dépend pas de la présence de catécholamines et n'est pas modifiée par le bêta-blocage. Il permet ainsi d'obtenir la fonction contractile cardiaque et la pression artérielle. Son action chronotrope positive peut parfois sembler plus modeste, car limitée par le blocage des bêtarécepteurs. Cependant, le glucagon peut accélérer un rythme d'échappement jonctionnel lent voire restaurer un rythme sinusal. Il est très bien toléré. La posologie initiale est de 2 à 10 mg en bolus IV sur 1 à 2 minutes. Son délai d'action est d'environ 3 min et son effet maximal obtenu en 5 à 7 min. En cas d'efficacité, le bolus est suivi par une perfusion continue, à la dose de 1-5 mg/h, en raison de sa demi-vie courte de 20 minutes. Les limitations sont son coût élevé (environ 100 euros pour une perfusion de 5 mg/h pendant 24 heures) et un risque d'épuisement du stock hospitalier lors d'utilisation de fortes doses.

L'insuline euglycémique à forte doses (1 UI/kg bolus puis 0,5 UI/kg/h avec perfusion de glucose hypertonique), proposée au cours des intoxications graves par inhibiteurs calciques, pourrait être intéressante pour les bêtabloquants. Mais l'expérience clinique est limitée à quelques cas publiés. Au décours d'une intoxication expérimentale par propranolol chez le chien, l'insuline, en comparaison au glucagon ou à l'adrénaline, a permis d'améliorer la survie en restaurant l'inotropisme et la pression artérielle, mais avec une réponse variable sur la fréquence cardiaque et les troubles conductifs.

Les émulsions lipidiques intraveineuses pourraient présenter un intérêt dans le traitement de certaines intoxications sévères. Leur mécanisme d'action n'est pas encore complètement clarifié : extraction tissulaire puis séquestration dans la phase lipidique (siphon lipidique), effet bénéfique métabolique par production d'ATP dans les myocytes ou action directe des acides gras modulant le dysfonctionnement des canaux ioniques. Quelques cas cliniques ont rapporté une amélioration miraculeuse d'une situation

hémodynamique paraissant compromise. Leur place reste cependant encore à préciser.

QCM7- L'adrénaline est la catécholamine de recours en cas de collapsus persistant malgré les 2 premières lignes d'antidotes **(Figure 2).** Elle est préférée pour les intoxications par bétabloquants avec effet alpha-bloquant comme le labétalol, ou vasoplégie. Les fortes doses d'adrénaline peuvent exposer au risque d'élévation rapide des résistances systémiques et de la post-charge, entraînant une baisse du débit cardiaque et un possible œdème pulmonaire cardiogénique, justifiant à ce stade, la nécessité d'une investigation hémodynamique complémentaire.

Les inhibiteurs des phosphodiestérases (énoximone, amrinone, milrinone), aux propriétés inotropes et vasodilatatrices intéressantes en cas d'insuffisance cardiaque à pression artérielle conservée, peuvent être utilisées chez certains patients après évaluation précise de l'état hémodynamique. Testés sur des modèles animaux ou décrits dans des cas cliniques, leur utilisation n'est pas conseillée en routine.

Le lévosimendan, nouvel agent inotrope de la classe des « calcium sensitizers », pourrait être une thérapeutique utile dans de telles intoxications. En se liant de façon sélective à la troponine C saturée en calcium, il prolonge la transformation structurelle de la troponine C habituellement transitoire, conduisant à une contraction myofibrillaire prolongée sans modification de la concentration du calcium intracellulaire, ce qui facilite la relaxation myocardique. Parallèlement à ces effets, le lévosimendan induit une vasodilatation coronaire, artérielle et veineuse périphérique, par ouverture des canaux potassiques ATP-dépendants des fibres musculaires lisses, pouvant améliorer la contractilité myocardique par baisse de la pré- et de la post-charge. Une étude expérimentale récente a retrouvé une amélioration de la survie et de l'état hémodynamique plus marquée avec le lévosimendan, en comparaison à la dobutamine ou le sérum salé.

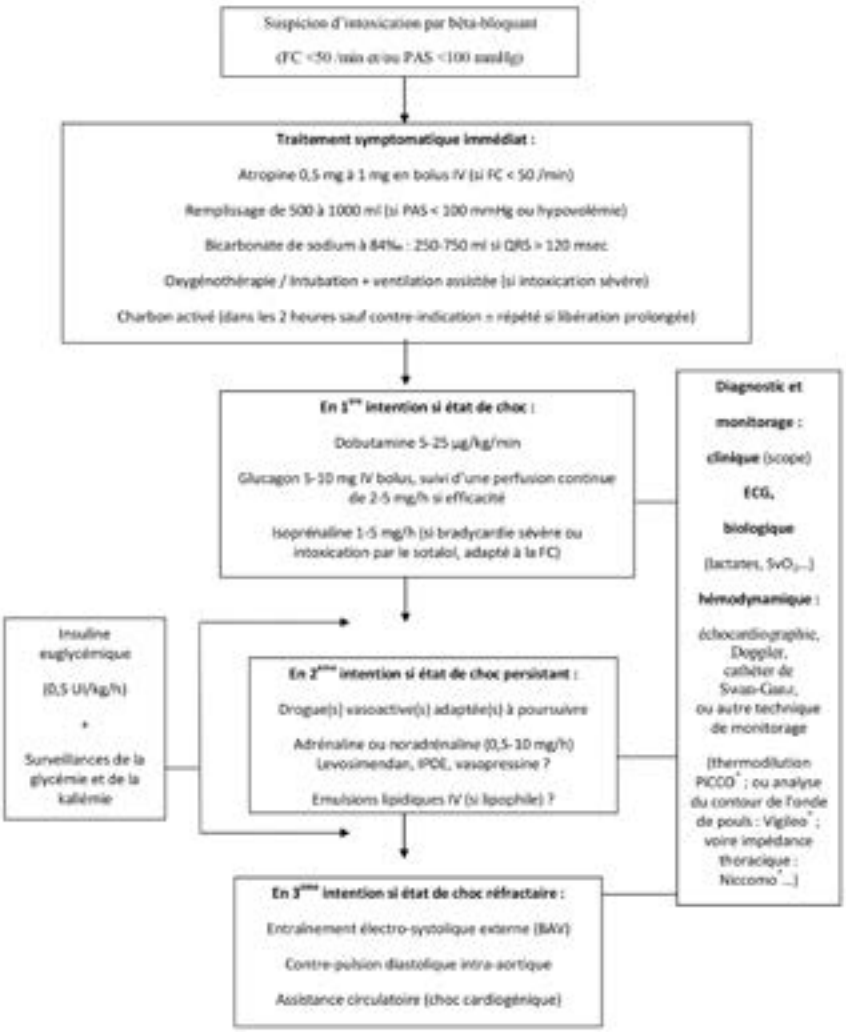


Figure 2. Algorithme thérapeutique en réanimation d'une intoxication par bétabloquant
FC : fréquence cardiaque, PAS : pression artérielle systolique. SvO2 : saturation veineuse centrale en oxygène. IPDE : inhibiteurs des phosphodiestérases.

L'entraînement électro-systolique peut être proposé pour les blocs auriculo-ventriculaires de haut degré, à condition que soit conservée l'inotropisme. Son efficacité est cependant modeste et les risques de complications mécaniques ou infectieuses en limitent les indications, devenues très rares depuis l'utilisation du glucagon et des fortes doses de catécholamines.

L'assistance circulatoire ou ECMO veno-artérielle avec cannulation chirurgicale fémorale et mise en place d'une pompe centrifuge à débit continu est la technique de sauvetage. Elle peut être proposée chez un patient intoxiqué par bêtabloquant présentant soit un arrêt cardiaque persistant survenu devant témoin et réanimé précocement, soit un choc cardiogénique réfractaire ou une arythmie ventriculaire maligne résistante aux thérapeutiques conventionnelles maximales. A la suite d'une intoxication par bêtabloquant avec effet stabilisant de membrane, la présence d'un choc cardiogénique réfractaire -malgré optimisation thérapeutique incluant ventilation mécanique, bicarbonates de sodium molaire, remplissage vasculaire adapté et perfusion en quantité suffisante de catécholamines (adrénaline > 3 mg/h) - associé à une hypoperfusion tissulaire comme une insuffisance rénale aiguë ou une hypoxémie majeure, semble prédictive de décès et donc justifier la mise en place d'une assistance circulatoire salvatrice, par une équipe multidisciplinaire médico-chirurgicale.

POUR EN SAVOIR PLUS:

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112 CALLS: REALLY UNCONSCIOUS?

M SMARANDOIU, A CANCIU, D FALAMAS, D TARAN. 112 Calls: Really unconscious?.
Med Emergency, MJEM 2013; 15: 46-47

Conference participation details:

LOCATION:
2nd Global Network Conference on Emergency Medicine, from 2-6 May, 2013 at the Al Bustan Rotana Hotel, Dubai in association with the Emirates Society of Emergency Medicine

TARGET: congress, worldwide, 4 continents

Team:
Marius Smarandoiu, Alin Canciu, Denisa Falamaş, Dana Taran
Oral presentation by Marius Smarandoiu

STORY:
- We sent abstracts of three studies about SMURD work for 3 years on a database of over half a million cases
- 2 studies have been accepted for the conference to be communicated in the form of poster:
    1. unconsciousness and the impact of educating people to create a mire efficient emergency system
    2. pediatric resuscitation in pre-hospital (SMURD ambulances)
- Two studies were selected for «Best scientific communication» and were sustained and presented orally to the scientific committee.
- We were awarded as «Best Oral Presentation» for «112 Calls: Really unconscious?» paperwork

Authors' affiliation:
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SMURD SIBIU, IGSU, LBUS – Victor Papilian Faculty of Medicine

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Background

Emergency care systems all over the world must continually adapt in order to achieve the best outcomes, often with as few resources as possible. Protocols are the new "gold standard" for everything: they work for patients as well as for organizing an efficient medical care unit. Technical infrastructure such as computers, CT scans and other medical gadgets are widely accessible. So, what else can be done until the patient reaches an ER department? Focus is shifted to managing pre-hospital units and population involvement. How important are these two parts in the chain of life? It turns out that greater things can be achieved by people with very little medical knowledge and that dispatchers can greatly influence the course of a medical intervention.

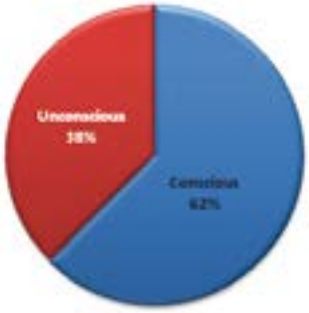
SMURD(Mobile Emergency Service for Resuscitation and Extrication) is the top emergency rescue service based in Romania. The goal of this study is to indirectly analyze these two major components: medical education of Romanian population and dispatching accuracy.

Methods

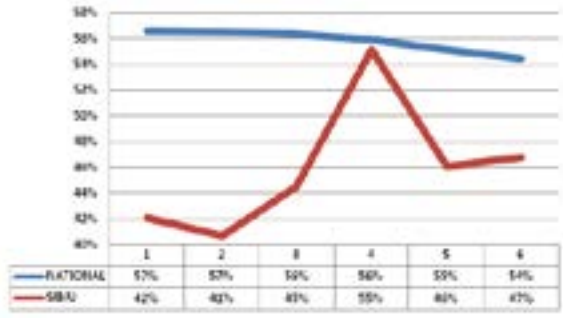
This retrospective study focuses on information extracted from SMURD national database of 589873 cases registered for a period of 3 years, between January 2010 and December 2012. Descriptive statistics was used in analyzing 87812 cases that met this inclusion criterion: patients of any age who have been declared by dispatchers unconscious and attended by EMS.

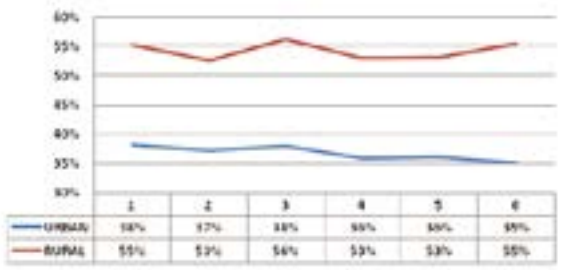
Results

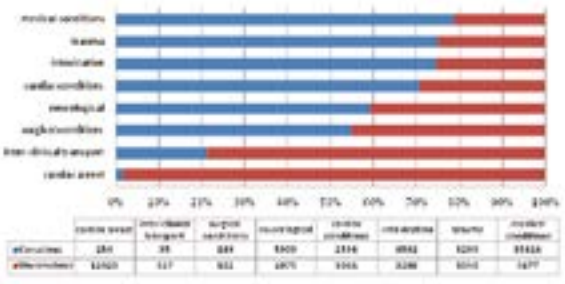
Analyzing the total number of emergency cases dispatched as unconscious ones, it was found out that from a total of 87812(urban and rural), only 38% of the patients were found unconscious, meaning that the majority of the cases were either poorly dispatched or erroneously identified by lay rescuers as unconscious.



For urban, looking on segments of 6 months it has been revealed for MICU cases a negative trend from 57% to 54% of unconscious patients found in unconscious alarms. A particular urban example is Sibiu city. Implementing BLS education programs for general population and measures to improve dispatcher assessment, there is a positive trend in time (42% to 47%). Although still Sibiu has a lower rate than national average.







There is a significant difference in the way the caller and the dispatcher evaluate a medical situation when we look at urban and rural location. The percentage is much better for rural (55%) than urban (36%). This can be explained by the fact that in rural areas people tend to solve their issues themselves and become a little more responsible than urban inhabitants that usually abuse the system. Even more, in urban areas things tend to become worse in time (38% to 35%).

The pathology type has an important impact in the correct population assessment and dispatching as so. Cardiac arrests were properly identified in 99% whereas trauma (25%) and cardiac conditions (29%) cases have high inconsistency in proper recognition of the case.

Conclusions

Emergency calls erroneously reporting a patient's state as „unconscious" are more likely to occur when the callers are not properly educated about knowing the difference between a conscious and an unconscious patient.

In wrong case assessment we may face the following:

a. no proper life saving measures are taken

b. wrong life saving measures are taken for the patient

c. incorrect dispatcher's guidance and decisions

d. the wrong type of response unit is dispatched (valuable resources are misdirected)

The current study concludes:

- providing BLS education in general population and raising the level of awareness about the responsibility of requesting an advanced unit ambulance will decrease substantially the percent of false unconscious cases.

- as a result of these measures and medical physicians being involved in dispatching process we expect SMURD to be able to provide more efficient and appropriate emergency service to the community.

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