Education and training of the perioperative nurses in trauma care: Role of the DPNTC course

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D – writing the article; E – critical revision of the article; F – final approval of the article

Clinical Education & Medical Simulation

Clin Edu Med Sim. 2020;3(1):5–14

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Funding sources
None declared

Conflict of interest
None declared

Received on September 8, 2020
Reviewed on December 7, 2020
Accepted on December 7, 2020

Published online on December 21, 2020

Abstract

Background. Caring for the critically ill patient requires specialized healthcare teams. The attendance of practical training courses enables participants to consolidate concepts and improve performance, helping them avoid errors and thus enhance the quality of care. Managing a polytraumatized patient in the operating room is substantially different from performing an elective surgery. Ideally, the whole team should have appropriate formal surgical trauma education. Courses such as the Definitive Perioperative Nurses Trauma Care (DPNTC), organized in parallel with the Definitive Surgical Trauma Care (DSTC) and Definitive Anesthesia Trauma Care (DATC) courses, aim to respond to this need and enhance quality of nursing care in trauma surgery by re-creating a multidisciplinary team experience.

Objectives. This article reviews the evolution of trauma care, focusing on the perioperative nurses' approach, identifying concerns and key challenges. We present the DPNTC course, describe our experience and report on the educational impact of training on learners.

Material and methods. A post-course survey was presented after the last 3 DPNTC courses to 34 participants. Candidates were asked to answer on five-point Likert scales addressing level of knowledge, technical skills and confidence (descriptive study with a retrospective analysis and Wilcoxon signed rank test; statistical significance when $p < 0.05$).

Results. A significant increase in the level of knowledge ($p < 0.001$), technical skills ($p < 0.001$) and confidence ($p < 0.001$) was reported.

Conclusions. Survey results highlight the importance of DPNTC to develop trauma management skills in the operative treatment of seriously injured patients. The uniqueness of the training program, which lies in the complementarity of the 3 joint courses (DSTC, DATC and DPNTC), could easily explain the results obtained in the survey.

Key words: Definitive Perioperative Nurses Trauma Care course, trauma surgery, damage control surgery, teamwork, nursing education/simulation

Cite as
Lourenço L, Pereira A, Alexandrino H, Baptista S, Mesquita C. Education and training of the perioperative nurses in trauma care: Role of the DPNTC course. *Clin Edu Med Sim* 2020;3(1):5–14. doi:10.17219/cems/131257

DOI
doi: 10.17219/cems/131257

Acknowledgements
We would like to acknowledge the Coimbra Hospital and University Center, which since the beginning supported this project – relationship strengthened by the ratification of an important protocol with ALTEC-LATES; and the Portuguese Army, in particular the assistance provided by the employees of the Military Health Center of Coimbra, with a special note for the tireless contribution of Nurse Director lieutenant-colonel Edgar Nunes and Clinical Director, doctor colonel Joaquim Cardoso. We emphasize the vital and valuable collaboration of the veterinary team during the practical sessions, led by doctors Pedro Pessa, Hugo Santos and Jorge Pimenta. We also acknowledge the group of pioneering nurses that have developed and implemented the DPNTC course in Australia, in particular nurse Eraine La Galle for all her sharing and support during one of the courses held in our center. Our special thanks are extended to all national and international DSApNTC faculties which have contributed to our improvement.

Introduction

The World Health Organization (WHO) and the Centers for Disease Control (CDC) estimate that more than 9 people die every minute due to trauma, that is to say, around 5.8 million people per year.[1] A trimodal death distribution shows that in most cases, death occurs within seconds to minutes after injury. Most of these deaths cannot be avoided because of the severity of the injuries. Apnea due to severe brain or high spinal cord injury, rupture of aorta or other large blood vessels and major injuries of the heart are the main causes of immediate death. Only primary prevention measures have noteworthy results in dropping this peak of trauma deaths. The 2nd crucial period occurs from minutes to several hours after injury. The major causes of death within it are epidural and subdural hematomas, hemopneumothorax, lacerations of the liver, ruptured spleen, pelvic fractures, and multiple other injuries related to considerable blood loss. The 3rd crucial period encompasses few days to weeks after injury, with multiple organ system dysfunction and sepsis as the main causes of death. The care provided in these periods will be determinant to the patient's outcome.[1]

The changes in trauma management in recent years have significantly altered this distribution. According to the American College of Surgeons, standardized training, as well as improved pre-hospital and hospital care (intervention protocols and specialized trauma teams), were decisive for this evolution.[1] Time is of the essence – when dealing with a multiple trauma patient, good preparation of healthcare teams will contribute to faster and more effective intervention, and consequently to reducing morbidity and mortality. The constitution of a trauma team promotes a "horizontal approach", leading to a rapid resuscitation and stabilization, diagnosis, and treatment.[2]

These concepts are valid for pre-hospital care, emergency room and intensive care, and naturally in case of surgical management. In order to improve resuscitation strategies and detecting early life-threatening injuries, standardized approaches have been created (for instance, the Advanced Trauma Life Support Course (ATLS®)). Early operative control is mandatory and some guidelines recommend that, on average, an unstable polytraumatized patient should not remain more than 30 min in the emergency department, but should be transferred to the operating room or the intensive care unit (ICU).[3]

In recent years, much emphasis has been placed on training professionals in the emergency room management of the severely traumatized patient. Courses such as the ATLS® and the Advanced Trauma Nurse Care (ATCN™) have helped many doctors and nurses develop their individual technical and decision-making skills. More recently, the European Trauma Course (ETC™) has sought to provide participants also with the non-technical skills required for a proper functioning team to accurately assess and resuscitate a severely injured patient.

Trauma management is a continuum of care and many patients will require emergent surgical treatment. This also requires specific training in the perioperative context. Moreover, sometimes patients in critical condition arrive at the operating room accompanied by the pre-hospital team, not stopping in the emergency department – this means that the perioperative team may have little or no time to prepare. Early communication and excellent preparation are vital in these circumstances.

The approach to the severely injured patient is an ongoing process. Most courses limit their scope to the emergency room; however, as Alexandrino et al. stated, "further training in the operative management is not only welcome but also highly needed".[4]

Perioperative nurses, as one of the key components of the surgical team, will also benefit from this training. The Definitive Perioperative Nurses Trauma Care Course (DPNTC) aims to be an essential contribution to improving quality of nursing care in surgical trauma and emergency surgery. The course is directed at perioperative nurses and emphasizes vital concepts, such as communication, teamwork, physiological priority-based approach, and correct identification and management of life-threatening injuries.

A post-course survey was implemented in the last 3 DPNTC courses (December 2018, June 2018 and December 2019) with the purpose to study the educational effect of the course on the level of knowledge, technical skills and degree of confidence of the participants. This invertigation aims to assess the impact of training on learners, evaluate the training process and upgrade future courses.

The DPNTC concept

The DPNTC course is a postgraduate nursing education program, designed for nurses with prior training regarding operating theater, namely scrub nurses, caring for critically injured trauma patients. It was initiated in 2004 in Sydney, Australia, and is now taught in Australia, New Zealand, Singapore, Canada, and Portugal.

The DPNTC was developed taking into account the Definitive Surgical Trauma Care (DSTC™) philosophy and is held simultaneously with this course. Also, the Definitive Anesthetic Trauma Care (DATC™) course can be added, giving rise to the DSApNTC acronym (Fig. 1).

The DSTC™ is a course for surgeons or advanced surgical trainees, and aims to provide the technical and decision-making skills in the operative treatment of severe trauma patients. The DSTC™ is based on the ATLS® principles adapted to the "second hour" of trauma, viewed as the "surgeons' time". It comprises concepts of surgical resuscitation strategy, priority setting and early definitive treatment. By order of priority, the objectives for the "second hour" are: prevention of early mortality by surgically controlling the bleeding; minimization of sepsis and multi-organ dysfunction; minimization of long-term deficits; reduction of short-term complications; and shortening hospitalization time.[5]

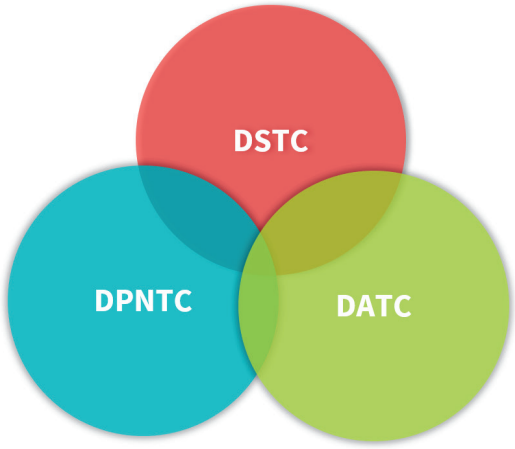

Fig. 1. DSApNTC (acronym created from the junction of the acronyms of the courses DSTC-DATC-DPNTC) highlights the fact that the 3 courses are held at the same time. There are moments of joint training and independent sessions according to the features of the courses themselves

The DATC™ is meant for anesthesiologists, or advanced anesthesiology trainees, aiming at developing their decision-making and resuscitation skills in perioperative period. The DSTC™ can function independently but is desirably held with the DATC™ and DPNTC simultaneously.

The DPNTC is directed at perioperative nurses and aims to improve the quality of the approach to polytraumatized patients. Candidates are usually scrub nurses with at least 2 years of operating room experience,[6] but this criterion can be tailored to institutional needs. The course values fundamental concepts, such as the integration of theoretical knowledge with clinical practice and training in surgical life-saving procedures. It is based on a physiological priority-based approach, correct identification and resolution of life-threatening injuries, decision-making, communication, and teamwork.

Simultaneously, the 3 courses (DSTC, DATC and DPNTC) aim to improve the provision of surgical care in critical situations, where there is severe and imminent risk of death, developing a common language and promoting a rapid and effective response.[7]

The DPNTC runs for 2 or 2.5 days, and of those, 1 day is essentially dedicated to simulation. The course format comprises lectures, scenario case discussion, surgical skills techniques demonstration, and practical laboratory session; it encompasses training of technical procedures, but also has a particular focus on non-technical skills.

Throughout the DSApNTC there are moments of joint training and separate sessions, according to each separate courses' schedules. The highpoint of the 3 courses is the simulation in a surgical laboratory of potentially real surgical trauma scenarios, in an environment identical in every aspect to an operating room, using a live, fully anesthetized animal model. This provides the unique opportunity for joint team training of a full operative room team, namely surgeons, anesthesiologists, scrub nurses and even anesthesia nurses. Individual training will then proceed, while providing the opportunity for training non-technical skills, such as communication, teamwork and role allocation.

Following the remarks of Tiel Groenestege-Kreb et al.,[2] we argue that the application of "horizontal approach" concept, where all members of the trauma team know what to do and work simultaneously, to the operation theater allows for gaining time and, consequently, for improving survival rates. To make this possible, good communication and teamwork are vital. All the team members must know the mechanism of injury, expected injuries, physiological parameters and methods of treatment implemented, and treatment guidelines to be adhered to. Such information should be conveyed to the operating room nursing team as soon as they are available and will assist in task scheduling and allocation. Training how this should be done is one of the key points of the DSApNTC course.

Incidence of trauma and injury patterns are different in different countries; thus, the country where the training is taking place can and must adapt the contents to their needs, never neglecting the essence of the course.[3] The fact that the DPNTC course runs concurrently with the DSTC™ and DATC™, with the presence of international faculty, contributes to a wide exchange of experience and knowledge, undoubtedly enriching the curriculum. Also, these training courses seek to develop an enjoyable and challenging environment, fundamental in modern education. This way of teaching was already proposed by Richardson and Miller[8] by suggesting that "improvement in trauma training should focus on making it an enjoyable educational opportunity that will appeal to surgeons for a lifetime".[8,9]

Topics such as communication, roles and responsibilities of the nursing team members, as well as priorities and preparation, are the basis of the DPNTC course. Other more specific issues are also addressed, such as mechanisms of injury, damage control, thoracic trauma, abdominal trauma, and staff safety procedures against professional hazards. The highpoint is the recreation of an operating room where training technical and non-technical skills is possible.

Recent studies have emphasized that good communication between all team members has a significant impact on patients' outcome. Adoption of standardized terminology and procedures, like closed-loop communication, could lead to safe communication.[10] According with Härgestam et al.,[10] "[c]ommunication has been found to be a key component in team building, and of importance for team performance. As time will constrain what the trauma teams can accomplish in terms of life-saving treatments in emergency situations, effective and clear communication is essential to prioritize and to create common goals in the team". The inclusion of standardized schemes of communication in courses such as DSApNTC is paramount; surgeon, anesthesiologist and nurse should speak the same language. Furthermore, considering an intervention of one

team member can have an effect on the action of other elements of the team, good coordination between surgeon, anesthesiologist and nurse is mandatory.[4]

Regarding this issue, a recent study looked at the educational effect of the joint DSTC™-DATC™ courses in improving intraoperative communication in trauma. A self-reported assessment shows a significant increase on surgeons' and anesthesiologists' awareness of the relevance of perioperative communication. The authors confirmed an important change in the candidates perception of the importance of preoperative team briefing, intraoperative regular/periodic communication and team debriefing after managing a severely injured patient. The use of standardized communication strategies such as closed-loop and direct communication was considered essential.[11]

Importance of simulation in training technical and non-technical skills

The publication of the report *To Err Is Human – Building a Safer Health System* by the Institute of Medicine of USA led to several studies that identified insufficient teamwork and communication as the major causes of adverse clinical events.[12] The use of simulation-based training was proven to be an important strategy for patient safety, as it allows healthcare students and professionals to improve education in real-life emergencies, practicing in a controlled environment, without the likelihood of causing harm or injury to patients.[13]

As Marr et al. stressed, real-life trauma resuscitation usually occurs in complex conditions, with time pressure and in stressful circumstances; thus, "[l]earning during these high-stress situations is generally poor".[13] Simulation-based training, taking place in a low-stress learning environment, facilitates learning and allows for training of both technical and non-technical skills, as is the case of communication and teamwork. The use of the debriefing and the possibility of repeating the scenario are also significant advantages of these techniques. Miller et al. denoted that "[s]imulation has been shown to improve performance of motor tasks, and previous studies reported findings suggestive of improved teamwork and communication after simulation".[14]

Several studies have shown that there is still a deficient management of trauma patients, and consider that the approach can be improved through specific training of the trauma teams.[15,16] Patient found in his literature review that there are serious deficiencies in trauma management.[17] He emphasized that better training of all team members is vital, with an aim to building structured trauma teams. Patient stated that nurses play a decisive role in the trauma patients care. He highlighted the pivotal role of nurses in communication and support of the patients, and upholding good communication between all team members.[17]

A follow-up study conducted by Hansen et al.[16] sought to analyze if a team-oriented perioperative trauma course on handling patients with life-threatening injuries had immediate educational benefits and if the acquired knowledges would be used in daily practice. Almost the whole study population (80%), made up of surgeons, anesthesiologists and nurses, considered that their ability to deal with critically injured patients improved and almost half of the surgeons and nurses started to include the techniques and principles learned in their daily routine. In this course, great attention was paid to the team-oriented training, emphasizing the importance of clear communication between all team members, verbalizing the operative plan and enhancing proactive attitude of the team members – this way of teaching was highlighted in the immediate aftermath of the course and in the follow-up questionnaires.[16]

There were only a few studies about simulation published within the framework of the professional nursing ongoing education. According to a systematic review by Jansson et al. between 2002 and 2011, only 1 study was published. This investigation showed that professional nursing simulation helped to enhance quality of care and patient safety.[18] Nursing simulation was initially used to train technical skills; nowadays, it has been focusing on "more dynamic complex and interpersonal human contexts"[19] – for instance, therapeutic or interpersonal communication, multisystemic approach, decision-making, prioritization, and clinical judgment.

Damage control surgery concept – training the perioperative nurse

Following the philosophy of the basis course (DSTC™), DPNTC is based on a modality of abbreviated and simplified treatment – damage control surgery (DCS). It is a relatively recent treatment modality, applied in patients with life-threatening conditions, unsuitable to be treated with conventional methods. Rotondo et al. proved the benefits of using shortened surgery instead of traditional long surgery repair – the survival rate rose from 11% to 77%, which means more than 60% of the patients survived when applied DCS techniques.[20]

Before the emergence of this concept, treatment of a severe trauma patient was performed in the same way and with the same principles as an elective surgery. In this sense, the intervention goes through the inherent principles of anatomy and pathology, advocating a definitive repair in a single session.[21] However, unlike scheduled patients, emergency patients generally have significant hemodynamic compromise, very low physiological reserve – and, consequently, more pronounced inability to tolerate prolonged procedures.

In light of these approach changes, the importance of "listening to the patient's cells" has become evident, that is, acting based not only on the anatomy of the injury itself

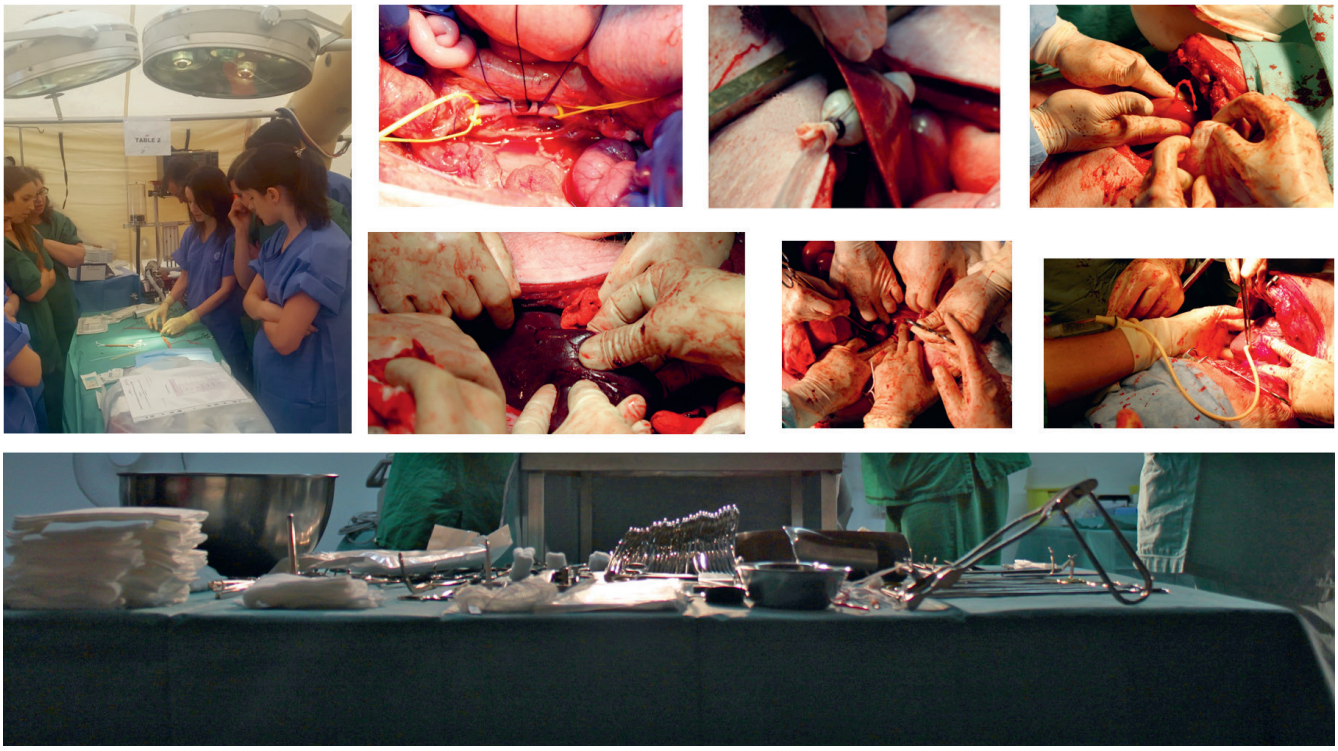

Fig. 2. The DPNTC (Definitive Perioperative Nurses Trauma Care) course comprises surgical skills techniques demonstration and practical laboratory session (the course teaches simple maneuvers, with the most common instruments, to solve the most complex situations)

but mostly on the patient's physiology. The DCS model advocates for rapid selection of these patients, ideally before entering in the so-called lethal triad (hypothermia, coagulopathy and metabolic acidosis),[4] followed by an abbreviated surgical approach by priorities, focused essentially on stopping the bleeding and controlling contamination. This is followed by an aggressive resuscitation in an ICU aiming at the recovery of physiological reserve. Only after physiological recovery are the definitive repair and abdominal closure completed.

Recently, the concept of DCS was linked with the concept of damage control resuscitation (DCR). The match between DCS and proactive treatment of coagulopathy, hypothermia and metabolic acidosis has been reported to be an important contribution in patient survival. The DCR comprises the use of permissive hypotension, blood component resuscitation scheme with early use of blood products, restricting crystalloid volume, restoration of normothermia, and reversal of coagulopathy.[3,22] When compared to the exclusive use of DCS, this holistic approach (DCS in association with DCR) leads to higher survival rates in the first 24 h and 30 days.[22,23]

The most difficult moment is often the decision-making. Changing the mindset of a team accustomed to dealing with elective surgery and rarely exposed to trauma surgery can be a real challenge. In an investigation held by Sonesson et al.,[24] experienced trauma experts concluded that the main educational dilemmas in decision-making are: thinking physiologically, application of DCS and DCR, lack of general surgical skills, time management and priorities, managing limited resources, impact of environment, ethical issues, and different culture-based behavior.

According to Molnar, "[t]he key element of damage control is to support the very basic life functions and keep the system under control without attempting to reach a definite solution at any price. This is a sort of surgery, where less is more. […] Damage control surgery is optimization instead of maximization of surgical aggressivity".[25] Time is paramount in trauma; if we realize that any surgical procedure is in itself a second blow to the patient, in unstable, traumatized patients, a rapid intervention is crucial to minimize the impact of the operative treatment.[4]

Although the DCS concept was initially created for trauma surgery, it has been applied in other areas.[4] Several studies have shown that the principles inherent in this model have a significant beneficial effect in patients in whom "loss of physiologic reserve with intolerance to the shock state" occurs.[21] That means that the patient's physiology is the starting point to decide an adoption of DCS.

The DPNTC course teaches simple maneuvers, with the most common instruments, to solve the most complex situations (see Fig. 2). The key is to be prepared and anticipate all the team steps, and respond quickly and effectively, aiming to improve the patients' outcome. To achieve that goal, we must focus on technical and non-technical skills, such as communication, teamwork, decision-making, and situation awareness. Non-technical skills are one of the main spotlights of the 3 courses. The concepts taught are not only applied in trauma, but also could be converted to non-trauma procedures, because, as we know,

at any time in any surgical procedure (even that who seems at first simple), adverse events can occur and the concepts achieved in courses like this one can be applied. Every day at any time we must be prepared for the worst, hoping for the best. Following this philosophy, we are always one step ahead, saving time, and, as was said before, timing is critical in this regard.

Material and methods

The first DPNTC course in Coimbra, Portugal, was held in 2007; till now, 13 courses were organized, with a total of 146 nurses trained under the auspices of the Lusitanian Association for Trauma and Emergency Surgery (ALTEC–LATES).

The surgical team training takes place in a simulated operating room environment. Since 2017, in Coimbra, this surgical laboratory is set up in a field hospital, where it is possible to arrange multiple simultaneous operating rooms. This team-training environment is a real challenge for both organization and institution involved. It starts from an empty outdoor sports field that turns in one scenario in everything similar to an operating room. (Fig. 3).

The model used is the live anesthetized pig under full veterinarian supervision. This model allows for observing and acting according with the physiological response to the injury and to the treatment performed. Other models would not result in such realistic simulation. The organization safeguards that all necessary conditions are ensured, in particular the respect for the 3 Rs: Reduce, Refine and Replace.

The 3 Rs doctrine arose in the context of animal experimentation from the need to find a dynamic balance between 2 fundamental values – science and animal welfare. It was first presented by Russell and Burch in the book *The Principles of Humane Experimental Technique*.[26] Nowadays, it is a desideratum globally accepted in the scientific community, constituting an animal experimentation ethical guiding model.

The Guiding Principles for Biomedical Research Involving Animals, published in 2012, upholds that "[t]he principles of the Three Rs – Replacement, Reduction and Refinement – should be incorporated into the design and conduct of scientific and/or educational activities that involve animals".[27,28] The principles favor high-quality science, while regulating and securing the maximum ethical consideration in the use of animals in scientific setting.[29] Moreover, several investigations carried out by the National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs) have strengthened the link between good quality of scientific outcomes and good animal welfare by stating that refinement strategies will promote both.[30] The authors feel that by incorporating 3 courses (DSTC, DATC and DPNTC) instead of only 1 (DSTC), as is the case in many countries worldwide, they uphold the commitment to good scientific and humane norms with the use of animal for surgical simulation, as each model will contribute to the training of a larger and more diversified group of healthcare professionals.

We usually recreate 6 operating tables. Twelve candidates are recommended for each DPNTC course; although a theoretical session allows for more participants, in practice sessions, 2 students per training station allows better monitoring to ensure a good acquisition of concepts and possibility of training of all available techniques. In that way, on average, for each surgical table, 7 candidates are present (2 nurses, 3 surgeons and 2 anesthesiologists).

Fig. 3. DSApNTC (acronym created from the junction of the acronyms of the courses DSTC-DATC-DPNTC) Coimbra team-training setting (a sports field is transformed into 6 operating rooms) with the deployment of a campaign hospital by the Portuguese Army

These students join an extensive team comprising of national and international faculty, coordinators, veterinarians, operational assistants and other ancillary personnel, adding to on average 90 people physically present in the field hospital.

The knowledge of the impact of training on learners, their evolution and specific needs, allows the organization and group of instructors to evaluate the training process and improve future courses. With the aim to study the influence of the course in the level of knowledge, technical skills and degree of confidence, a post-course survey was performed after the last 3 DPNTC courses (December 2018, June 2019 and December 2019). The participants were asked to answer on five-point Likert scales and the surveys were analyzed using SPSS v. 26.0 software (IBM SPSS Inc., Armonk, USA; Wilcoxon signed rank test, with statistical significance considered when p-value less than 0.05). It consists of a descriptive study with a retrospective analysis.

Results

All the 34 nurses who had taken part in the course responded to the inquiry. The mean age of the study population was 38 years (range: 29–56 years) and the participants were predominantly female (n = 27, 79.41%). Mean working experience was 10 years (range: 4 months–22 years) and mean instrumentation time was 8 years (range: 0–20 years). Most participants reported some experience in trauma treatment (67.65%).

Regarding the learners' level of knowledge, technical skills and degree of confidence (five-point Likert scale rank level, in which 1 represented "very weak" and 5 represented "very good"), the average pre-course responses ranged from 2.38 to 2.59 and the average post-course responses – from 3.82 to 3.94 (Table 1). A positive change was observed between the pre- and to post-course learners' evaluation.

Analyzing the level of knowledge, it turns out that before the DPNTC course, almost all nurses felt they had a "reasonable" level (61.76%); however, some assessed themselves at the "very weak" or "weak" level (14.71% and 17.65%, respectively). The post-course evaluation indicated that 76.47% of the candidates declared they achieved a "good" level of knowledge in trauma surgery; some of them reached a "very good" level (8.82%), meaning that there was a significant improvement of the level of knowledge ($p < 0.001$) (Fig. 4A).

With regard to the technical skills, before DPNTC, the candidates self-reported them as "very weak", "weak" or "reasonable". After attending the course, the vast majority (70.59%) declared having "good" technical skills to deal with a polytraumatized patient ($p < 0.001$) (Fig. 4B).

Before participating in the DPNTC course, the candidates declared having a low degree of confidence to approach a surgical trauma victim ("reasonable", "weak" and "very weak" – 41.18%, 38.23% and 14.71%, respectively). Of the 34 participants, 70.59% felt they achieved a "good" degree of confidence after attending 3 days of training. All the above shows that the degree of confidence improved significantly (very strong level of significance with p-value < 0.001) (Fig. 4C).

On the five-point Likert scale, in which 1 represented "useless" and 5 represented "very useful", almost all nurses pointed out that the DPNTC is "very useful" (91.18%), while the remaining participants regarded the course "useful" (Fig. 4D).

Of the 34 participants, 85.29% declared that the knowledge acquired is applicable in their daily routine. When asked if they would recommend the course, all the study population said "yes". Most of the participants assumed that the course surpassed expectations (67.65%) and the others said it lived up to expectations (32.35%).

Discussion and Conclusions

Although in recent years awareness for the importance of simulation in the context of healthcare has been rising, very few studies have been published in the professional postgraduate nursing field.[18] This fact is particularly visible in trauma context. Identifying and recognizing the scientific value of simulation to improve the performance of healthcare professionals and, parallel, to ensure high-quality, safe and efficient healthcare, as well as improvement of patients' outcome, may be the right way to encourage and promote individual and institutional participation in this kind of training.

With regard to trauma, simulation can be particularly important due to the need for rapid and effective response,

Table 1. Learner's level of knowledge, technical skills and degree of confidence before and after attending the DPNTC course (December 2018, June 2018 and December 2019) (five-point Likert scale rank level, in which 1 represents "very weak" and 5 represents "very good" (Wilcoxon signed rank test))

Variable	Before DPNTC				After DPNTC				p-value
	N	mean	minimum	maximum	N	mean	minimum	maximum	
Level of knowledge	34	2.59	1	4	34	3.94	3	5	<0.001
Technical skills	34	2.50	1	4	34	3.88	3	5	<0.001
Degree of confidence	34	2.38	1	4	34	3.82	3	5	<0.001

DPNTC – Definitive Perioperative Nurses Trauma Care.

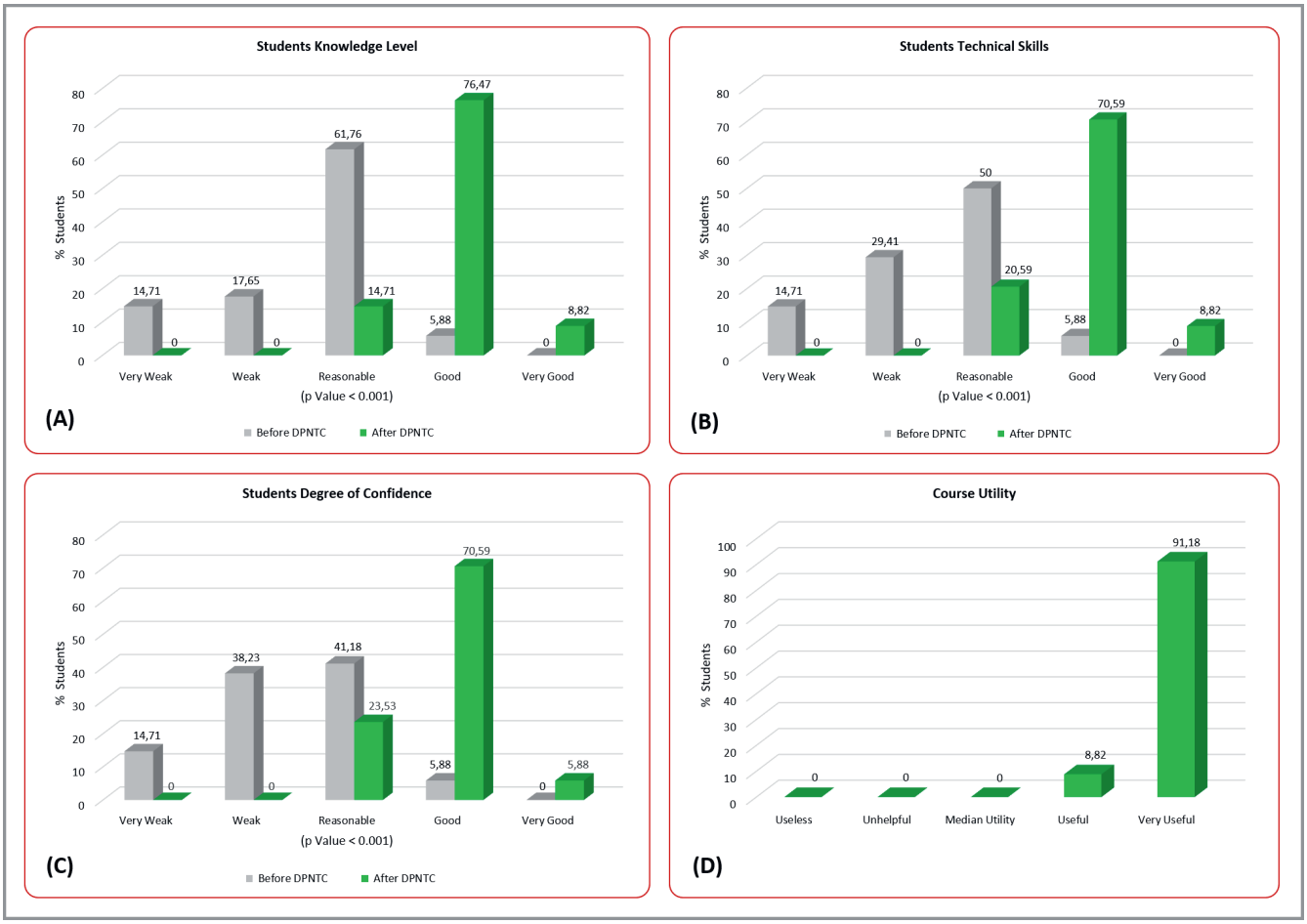

Fig. 4. Results from the post-course survey presented in the last 3 DPNTC (Definitive Perioperative Nurses Trauma Care) courses in Coimbra (December 2018, June 2019 and December 2019 (N = 34)). A. Level of knowledge in trauma surgery perceived by the study population before and after attending the DPNTC course. B. Technical skills to deal with a surgical severely injured patient perceived by the study population before and after attending the DPNTC course. C. Degree of confidence to approach a surgical trauma victim perceived by the study population before and after attending the DPNTC course. D. Classification of the DPNTC course regarding its usefulness as perceived by the study population after attending the DPNTC course

especially in countries where there is a low incidence of severe cases. Moreover, approaching a severely injured patient in the operating room is markedly different from performing an elective surgery, with a different mindset required. This training should take place in a controlled environment, which is an enhancer and facilitator of comprehensive training. Training courses, such as DSApNTC, carried out in a controlled and safe setting, aim to respond to this need.

Our results allows us to conclude that there was a significant increase in the level of knowledge, technical skills and degree of confidence in the course participants, meeting the objectives of the healthcare simulation. Survey results also highlight the importance of post-graduate nursing education/training in the field of trauma to develop trauma management skills in the operative treatment of seriously injured patients. The combination of theoretical knowledge with clinical practice and training in surgical life-saving procedures, in a teamwork setting, contributes to a significant improvement of technical and non-technical skills and responsible confidence. Centered on DCS concept, in a philosophy where simplicity and abbreviation can make a difference,, the DSApNTC demystifies the complexity that is usually associated with approaching an unstable, polytraumatized patient; as Leonardo da Vinci stated: "Simplicity is the ultimate sophistication".

Additionally, almost all nurses deemed the DPNTC course "very useful", not only in case of surgical trauma and emergency surgery, but also for their daily routine. Although learning is targeted at addressing severely injured patients, the general acquired concepts may be applied to non-emergent and non-traumatic cases. Post-course informal reports denote a vital change of mentality, reinforcing the importance of communication and teamwork. The Norwegian follow-up study had already confirmed the benefits of this kind of training in the short and medium term.[16]

Considered by many as one of the greatest challenges of medicine, the success of the trauma resuscitation and surgery is undoubtedly achieved through excellent teamwork and appropriate communication strategies.[11] The uniqueness of the training program, which lies in the organizational complexity and formative

complementarity of the 3 joint courses, could be the main reason of the results obtained in the survey. Replicating potentially real situations with the utmost scientific rigor favors the involvement of the trainees and facilitates their learning. The fact that all participants will recommend the course further supports this premise.

DPNTC – future and challenges

Education research is vital to assess the impact of surgical simulation training on patient care. With a view to improving nursing education and therefore patient outcomes, the course is constantly updated, taking into account the scientific developments and evaluations carried out by the trainees in each course.

Although this survey confirmed a significant improvement in knowledge level self-assessment, technical skills and degree of confidence immediately after attending the DPNTC, we consider that it is important to carry out further studies to determine medium and long-term impact, as well as improvement in patient outcomes. Taking into account a very small sample, it would be rather ambitious to generalize the results. However, we have seen a positive impact that allows us to think that trauma education/training could enhance scrub nurses' performance.

Despite the course was planned to train scrub nurses, our group is currently developing an anesthesia module for nurses; DCS and DCR are inseparable – together they are the key point to improve operative treatment of trauma patients. As far as the authors are aware, such a module for anesthesia nurses in trauma has never been developed before and the authors are committed to its development. In order to improve nurses´ postgraduate education in trauma and emergency surgery, our organization aims to reach more healthcare professionals, hoping that the course will spread around the world, along with DSTC™ and DATC™. In our perspective, it makes perfect sense that all 3 courses take place simultaneously.

In the authors' opinion, the way in which the course is organized facilitates and empowers the inter-professional learning, concept understood as "when two or more professions learn with, from and about each other to improve collaboration and the quality of care" (Department of Health quoted by Patient).[17] We also believe that it is important to strengthen relations with other countries that organize the DPNTC course, so that together we can find the best teaching strategies and build a wider surgical knowledge.

The biggest challenge will be to be recognized as a valuable and essential course for all the operating-room nurses who work in operating theatres with trauma and emergency cases. Understanding learning as an ongoing process, we argue that the DPNTC lays the foundation for guiding the perioperative trauma patient's treatment (technical and non-technical skills); in this sense, nurses' continuous training is important, translating these principles into everyday work practices.

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References

1. American College of Surgeons. *Advanced Trauma Life Support*. 10th ed. Chicago, IL: American College of Surgeons; 2018. doi:10.1111/j.1365-2044.1993.tb07026.x
2. Tiel Groenestege-Kreb D, Van Maarseveen O, Leenen L. Trauma team. *Br J Anaesth*. 2014;113(2):258–265. doi:10.1093/bja/aeu236
3. Boffard K, ed. *Manual of Definitive Surgical Trauma Care: Incorporating Definitive Anaesthetic Trauma Care*. 5th ed. Abingdon-on-Thames, UK: Taylor & Francis; 2019.
4. Alexandrino H, Baptista S, Mesquita C. Surgical education in trauma: Physiology, damage control and the DSTC™ course. *Clin Edu Med Sim*. 2018;1(1):5–10. doi:10.17219/cems/93774
5. Hospital de S. João. Trauma: a hora do cirurgião. *Bol Trauma*. 2002; 1(3):2–3.
6. Liverpool Hospital. Definitive Perioperative Nurses Trauma Course. https://dstc.com.au/wp-content/uploads/2017/01/2017-DPNTC-Booklet.pdf.
7. Ordem dos Médicos. Normas de boa prática em trauma. *Ordem dos Médicos*. 2009:224. https://ordemdosmedicos.pt/normas-de-boa-pratica-em-trauma/ Accessed August 5, 2020.
8. Richardson J, Miller F. Will future surgeons be interested in trauma care? Results of a resident survey. *J Trauma*. 1992;32(2):229–235. doi:10.1097/00005373-199202000-00020
9. Spain DA, Miller FB. Education and training of the future trauma surgeon in acute care surgery: Trauma, critical care, and emergency surgery. *Am J Surg*. 2005;190(2):212–217. doi:10.1016/j.amjsurg.2005.05.014
10. Härgestam M, Lindkvist M, Jacobsson M, Brulin C, Hultin M. Trauma teams and time to early management during in situ trauma team training. *BMJ Open*. 2016;6(1):e009911. doi:10.1136/bmjopen-2015-009911
11. Alexandrino H, Baptista S, Vale L, et al. Improving intraoperative communication in trauma: The educational effect of the Joint DSTC™–DATC™ courses. *World J Surg*. 2020;44(6):1856–1862. doi:10.1007/s00268-020-05421-5
12. Kohn L, Corrigan J, Donaldson M, eds; Institute of Medicine. *To Err Is Human. Building a Safer Health System*. Vol. 6. Washington, DC: The National Academies Press; 2001. doi:10.17226/9728
13. Marr M, Hemmert K, Nguyen AH, et al. Team play in surgical education: A simulation-based study. *J Surg Educ*. 2012;69(1):63–69. doi:10.1016/j.jsurg.2011.07.002
14. Miller D, Crandall C, Washington C, McLaughlin S. Improving teamwork and communication in trauma care through in situ simulations. *Acad Emerg Med*. 2012;19(5):608–612. doi:10.1111/j.1553-2712.2012.01354.x
15. Armstrong B, Crouch R, Read C, Palfrey R. Training nurses in trauma management. *Emerg Nurse*. 2013;21(4):14–18. doi:10.7748/en2013.07.21.4.14.e1137
16. Hansen KS, Uggen PE, Brattebø G, Wisborg T. Training operating room teams in damage control surgery for trauma: A follow-up study of the Norwegian model. *J Am Coll Surg*. 2007;205(5):712–716. doi:10.1016/j.jamcollsurg.2007.06.015
17. Patient L. Trauma training: A literature review. *Emerg Nurse*. 2007; 15(7):28–37. doi:10.7748/en2007.11.15.7.28.c6255
18. Garvey P, Liddil CJ, Eley RCPS, Winfield S. Trauma tactics: Rethinking trauma education for professional nurses. *J Trauma Nurs*. 2016; 23(4):210–214. doi:10.1097/JTN.0000000000000218
19. Dunnington RM. The nature of reality represented in high fidelity human patient simulation : Philosophical perspectives and implications for nursing education. *Nurs Philos*. 2014;15(1):14–22. doi:10.1111/nup.12034
20. Rotondo MF, Schwab CW, McGonigal MD, et al. 'Damage control': An approach for improved survival in exsanguinating penetrating abdominal injury. *J Trauma*. 1993;35(3):375–383, discussion 382–383. doi:10.1097/00005373-199309000-00008

21. Waibel B, Rotondo M. Damage control surgery: It's evolution over the last 20 years. *Rev Col Bras Cir*. 2012;39(4):314–321.
22. Beldowicz BC. The evolution of damage control in concept and practice. *Clin Colon Rectal Surg*. 2018;31(1):30–35. doi:10.1055/s-0037-1602177
23. Cotton BA, Reddy N, Hatch QM, et al. Damage control resuscitation is associated with a reduction in resuscitation volumes and improvement in survival in 390 damage control laparotomy patients. *Ann Surg*. 2011;254(4):598–605. doi:10.1097/SLA.0b013e318230089e
24. Sonesson L, Boffard K, Lundberg L, Rydmark M, Karlgren K. Decision-making in management of the complex trauma patient: Changing the mindset of the non-trauma surgeon. *World J Surg*. 2018;42(8):2392–2397. doi:10.1007/s00268-018-4460-x
25. Molnar TF. Thoracic damage control surgery. *J Thorac Dis*. 2019;11(10):S158–S166. doi:10.21037/jtd.2018.11.32
26. Russell WMS, Burch RL. *The Principles of Humane Experimental Technique*. London, UK: Methuen; 1959.
27. Council for International Organization of Medical Sciences and The International Council for Laboratory Animal Science. International Guiding Principles for Biomedical Research Involving Animals. https://olaw.nih.gov/sites/default/files/Guiding_Principles_2012.pdf.
28. Hubrecht R, Carter E. The 3Rs and humane experimental technique: Implementing change. *Animals (Basel)*. 2019;9(10):754. doi:10.3390/ani9100754
29. Kirk R. Recovering the principles of humane experimental technique: The 3Rs and the human essence of animal research. *Sci Technol Hum Values*. 2018;43(4):622–648. doi:10.1177/0162243917726579
30. Prescott M, Lidster K. Improving quality of science through better animal welfare: The NC3Rs strategy. *Lab Anim (N Y)*. 2017;46(4):152–156. doi:10.1038/laban.1217