



# Knowledge survey regarding blast wound education of student doctors at a local academic medical university in Japan

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## ABSTRACT

**Objective:** To improve knowledge about blast injury for medical student doctors or surgeons. In the modern uncertain era, education and training programs for blast injuries for medical student doctors or surgeons are recently necessary worldwide.

**Material and Methods:** To understand primary corresponding ability to treat blast injuries, leading to improvement of the trauma education curriculum, a retrospective study by a knowledge survey was performed between 2018 and 2019. The subject had the title of Student Doctor (SD) at university.

**Results:** The answers of 183 participants who answered the interview questionnaire with 16 questions were summarized. Although most SDs received basic lectures for trauma medicine and majority of SDs knew about mass casualty incidents and primary treatment, the existence of knowledge on soft targets is limited. One-fourth of the SDs knew the characteristics of blast wounds. Most SDs understood priority triage for a conscious person with massive bleeding from a limb with hemostasis to save lives. The 17% selected cardiopulmonary resuscitation first and 72% of SDs could explain hemorrhagic shock; however, only four could explain adequate hemostatic procedures. Most had no interest regarding necessity of their knowledge in the field of serious blast trauma wounds.

**Conclusion:** Experience in trauma surgery training from stages in SDs and authorized education are important for raising students' knowledge of unexpected serious blast incidents.

**Keywords:** Surgical education, medical university, student doctors, blast surgery, trauma team

## INTRODUCTION

Trauma surgery used to be a common specialization for medical physicians worldwide. However, such an education by a point of surgery seems to be generally neglected in Japan because of few experiences and opportunities after World War II (1), resulting in a significantly low level of awareness or knowledge among general surgeons. Recently, indiscriminate blast injuries occurred as a result of the Boston bombing in 2013 (2), the Las Vegas shooting in 2017 (3) and the Lebanon explosion in 2020 (<https://www.facs.org/International/webinar/mass-casualty-management>) (4). Urgent primary treatments for wounds by citizens or emergency room (ER) departments seem to be well recognized from primary education among ordinary people in many countries (<https://www.stopthebleed.org/>) (5). However, in Japan, usually only classical resuscitation or defibrillator training is still performed, even in medical teaching institutes. Globalization and government inbound policies in the last decade have resulted in an increase in foreign visitors, information and industrial equipment. It is speculated that unexpected or unusual accidents have occurred in Japan.

For the faculty lecturers of medical universities, a high degree of basic education for medical students who have the title of student doctor (SD) after clinical examinations is necessary during lectures on clinical practice before internships. Not only ER specialists but also trauma surgeons must establish practically useful curricula in the near future, even in local or regional universities, because our city, Miyazaki, has many special sports facilities and some military bases and was designated

**Cite this article as:** Kawano F, Munakata S, Tashiro K, Ikenoue M, Furukawa K, Ochiai H, et al. Knowledge survey regarding blast wound education of student doctors at a local academic medical university in Japan. Turk J Surg 2022; 38 (1): 74-80.

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Received: 29.09.2021

Accepted: 09.11.2021

Available Online Date: 28.03.2022

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DOI: 10.47717/turksurg.2022.5537

an expected tsunami hazard area after the expected Nankai megathrust earthquake (6). Furthermore, even in Japan, there were approximately 380 cases of terror attacks between 1990 and 2010. Although mass injuries were rare, recognition in Japanese citizens seems to be less common (7). We hypothesize that efforts for such a specific education may lead to the recruitment of trauma surgeons and the improvement of the clinical ability of general physicians in case of a crisis. Some special attractive programs initiated in the last decade still seek to improve the recruitment system of physicians from rural areas of Japan (8,9). Thus, education on trauma surgery will be included in the recent program under the development of the macrochair system of the Department of Surgery at the University of Miyazaki Faculty of Medicine since 2015 (<http://www.med.miyazaki-u.ac.jp/home/english/departments/surgery/>) (8).

Considering this situation, we first surveyed the knowledge and awareness of 183 recent SDs in the present study to complete the effective teaching and training education model in next step. To show our pilot effort, the outcomes of this program were preliminarily analyzed.

## MATERIAL and METHODS

The present survey was conducted between October 2018 and December 2019. The questionnaire participants included 183 curriculum Phase I (equivalent to 4<sup>th</sup>-year grade, n= 129) and Phase II (equivalent to 5<sup>th</sup>-year grade, n= 54) medical students who had a title of SD after completing the Japan medical common achievement examinations such as the national computer-based test and the objective structured clinical examination at the University of Miyazaki Faculty of Medicine. The teaching staff included several experienced trauma team surgeons from the thoracic, cardiovascular and digestive groups from the Department of Surgery. After institutional ethical approval was obtained (acceptance number #C-0049, 2018), documents for permission regarding human subject protection for this survey and student' and instructors' agreement were obtained before the study.

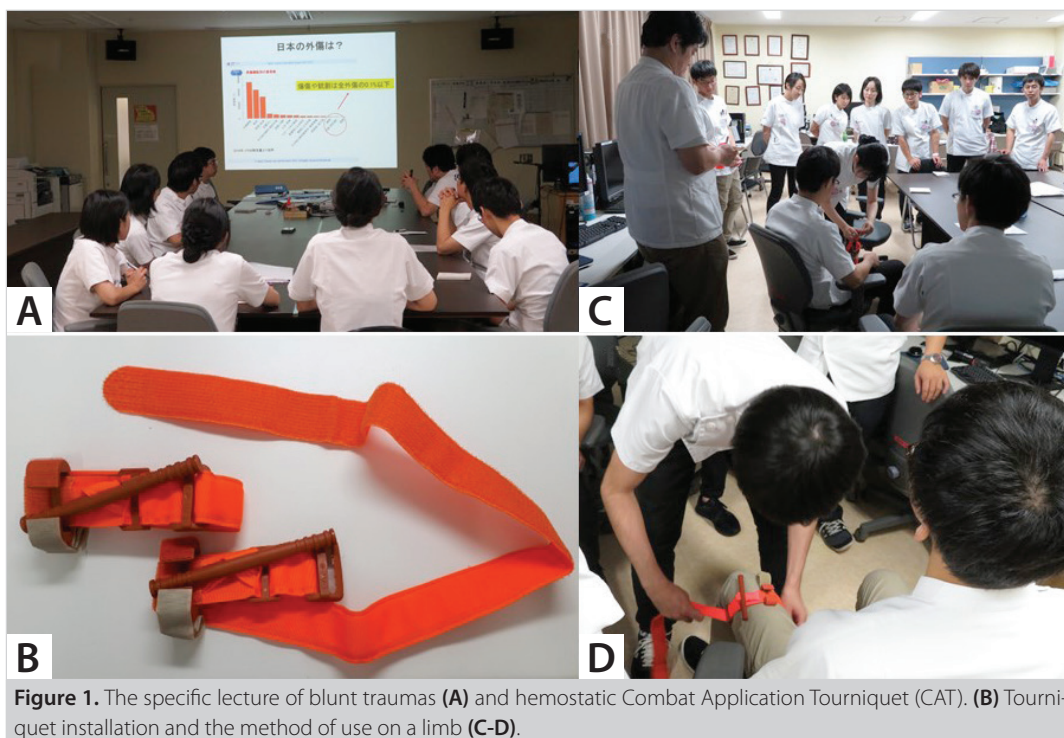
The specific 16 questions related to interests regarding blast wound surgery were the following: Q1) sex; Q2) did or did not take a lecture regarding trauma surgery in the 4<sup>th</sup> grade; Q3) did or did not finish clinical practice in the ER department; Q4) did or did not take the nationwide Basic Life Support (BLS) lecture; Q5) knowledge regarding mass casualty incidents; Q6) which of the following is a mass casualty incident? (choices: a) derailment of an express train, b) indiscriminate shooting, c) large earthquake, d) indiscriminate bombing terror attack, and e) indiscriminate chemical weapon terror attack); Q7) knowledge regarding soft and hard targets in indiscriminate terror attacks; Q8) explanation of the characteristics in gunshot wounds and

bomb wounds; Q9) the best selection of the SD in case encountering a gunshot or bomb wound accident (choices: a) capture the perpetrator, b) life-saving focusing on serious injured persons, c) ensuring your own safety and d) request support); Q10) the first treatment priority in a mass casualty incident with many injured persons (choices: a) an unconsciousness young girl not responding after many gunshot wounds to her chest after intubation, b) a middle-age male who had massive bleeding from a blast wound on a lower limb without pulsation of the radial artery, c) a disabled person who is speaking well and has stable vital conditions but difficulty walking due to contusions on limbs, and d) an elderly person with many abrasions who is able to walk autonomously); Q11) selection of the priority treatment for dismemberment by blast wounds (choices: a) resuscitation, b) hemostasis, c) infection prevention and d) collection of injured pieces); Q12) explanation of hemorrhagic shock; Q13) received a lecture on hemostasis after trauma; Q14) explanation of adequate hemostatic procedures in trauma patients; Q15) necessity of own knowledge regarding severe trauma injuries; and Q16) the method of using a combat application tourniquet.

Before training in hemostasis, we first gave a lecture on gunshot and blast injuries and terrorist attacks (Figure 1A). In this lecture, we did not only mention the pathophysiology and treatment of gunshot and blast injuries but also explained the initial response in the event of such an accident in more detail. Hemostasis training was performed using Stop the Bleed course materials (<https://www.stopthebleed.org/>). The first training step was to follow this manual and understand how to ensure personal safety and the ABCs of controlling bleeding in an emergency. The second step was basic hemostatic training using gauze pressure and wound packing. The third step was dry training of the Combat Application Tourniquet (CAT) method (Figures 1B-D). The rapid triage, repeated training and morals of surgeons were emphasized by the staff surgeons during these programs.

Training was started in curriculum phase I and II for SDs after the questionnaire and lecture. All phase I SDs performed surgical practices for four weeks in our department. During this period, students first performed basic surgical procedures such as surgical knot tying, sutures, and resuscitation in the field of trauma surgery. The curriculum phase II SDs who selected surgical programs practiced for 4 wk. and learned more actual clinical practices.

We conducted special wet laboratory training called the Miyazaki Advanced General Surgery of University "MANGOU" project in the vacation period by calling for participation. Trainees practiced suturing techniques using experimental use animal organs.



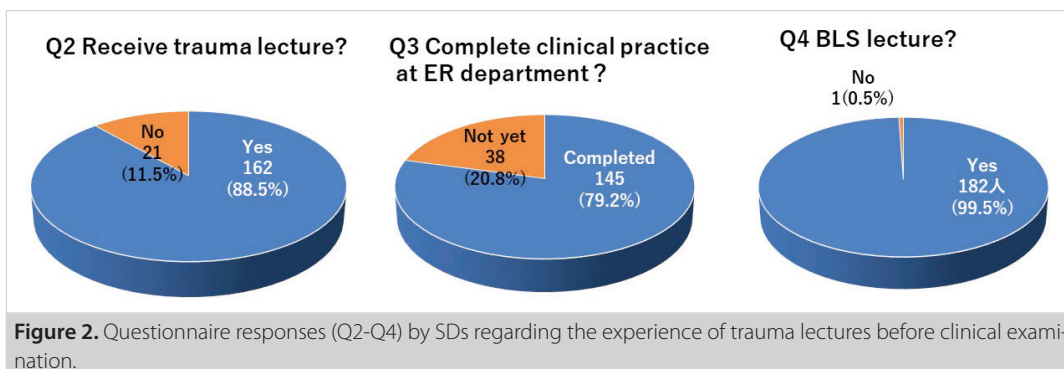
**Figure 1.** The specific lecture of blunt traumas (A) and hemostatic Combat Application Tourniquet (CAT). (B) Tourniquet installation and the method of use on a limb (C-D).

## RESULTS

The results and answers of the 183 participants who answered the interview questionnaire with 16 questions were summarized. Of the 183 participants, 118 (65%) were males and 65 (36%) were females. Figure 2 (Q2-Q4) shows the status of the lectures or practice regarding trauma surgery and emergencies. Although trauma surgery and BLS lectures were optional, most SDs received the basic lectures. As the clinical practice curricula in the departments of ER and surgery were built in the same period, 21% of SDs did not have prior ER experience. Figure 3 (Q5-Q7) shows the results of knowledge about mass casualty incidents (MCIs). Only half of SDs knew about MCIs, but the prevalence of selective queries seemed to recognize natural disasters, large-scale traffic disasters, and terrorism as MCIs. Furthermore, knowledge on the existence of soft targets in MCIs is hardly known among SDs.

Figure 4 (Q8-Q11) shows knowledge about gunshots or bombings, including the first action choice or the first treatment for injured persons. One-fourth of SDs knew a little about the characteristics of blast wounds, and the majority had no knowledge. In blast incidents, most selected securing their own lives, which was recognized as most SD understanding the important of self-defense in such a situation. Most SDs selected treating a conscious person with massive bleeding from a limb, and many selected the treatment option of hemostasis of the limb. However, 17% of SDs selected cardiopulmonary resuscitation.

Figure 5 (Q12-Q16) shows the results of knowledge regarding massive bleeding and hemostasis. Seventy-two percent of SDs could explain hemorrhagic shock while 28% could not. In fact, only 23% of SDs received specific lectures on hemostatic procedures in trauma. Therefore, only four could explain adequate hemostatic procedures and 61% of SDs were indifferent. Most



**Figure 2.** Questionnaire responses (Q2-Q4) by SDs regarding the experience of trauma lectures before clinical examination.

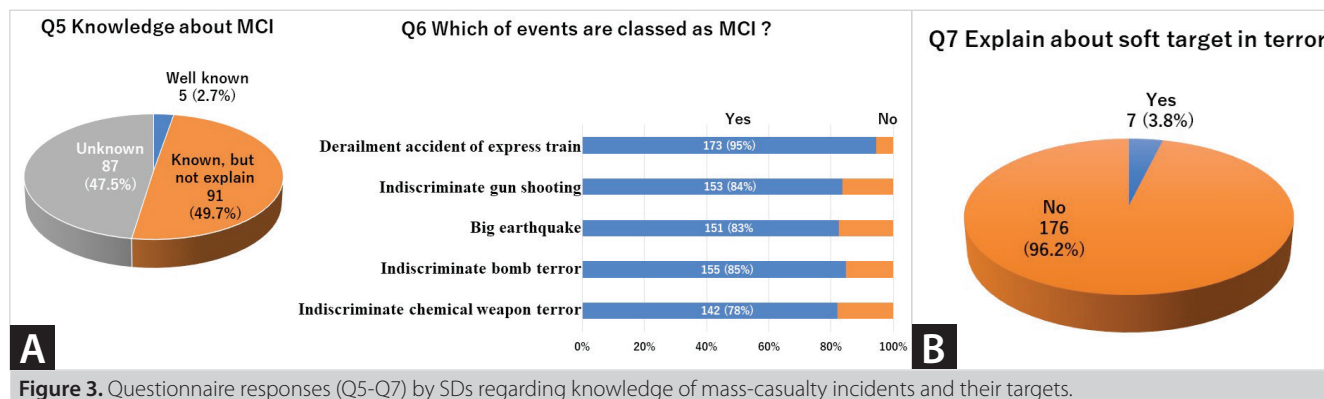


Figure 3. Questionnaire responses (Q5-Q7) by SDs regarding knowledge of mass-casualty incidents and their targets.

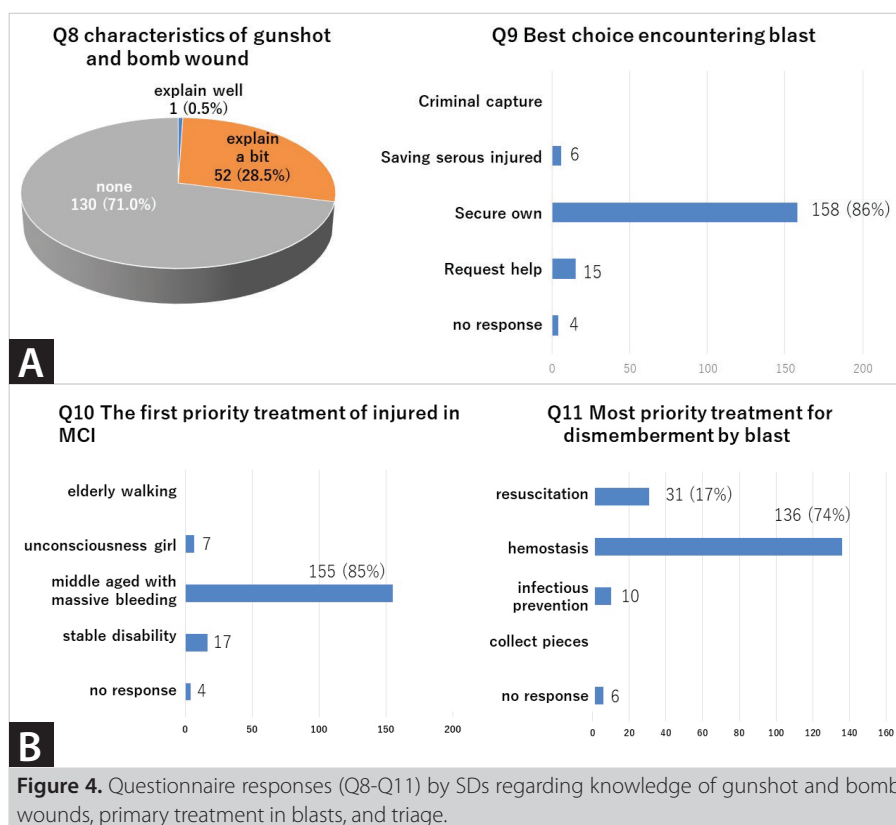


Figure 4. Questionnaire responses (Q8-Q11) by SDs regarding knowledge of gunshot and bomb wounds, primary treatment in blasts, and triage.

SDs had no interest in improving their own knowledge in the field of serious trauma injuries including blast wounds.

Approximately 20% of SDs know about hemostatic tourniquets and their use, which is well known in ordinary people worldwide. However, no SD could apply a tourniquet correctly in practical training and answer the presented questions.

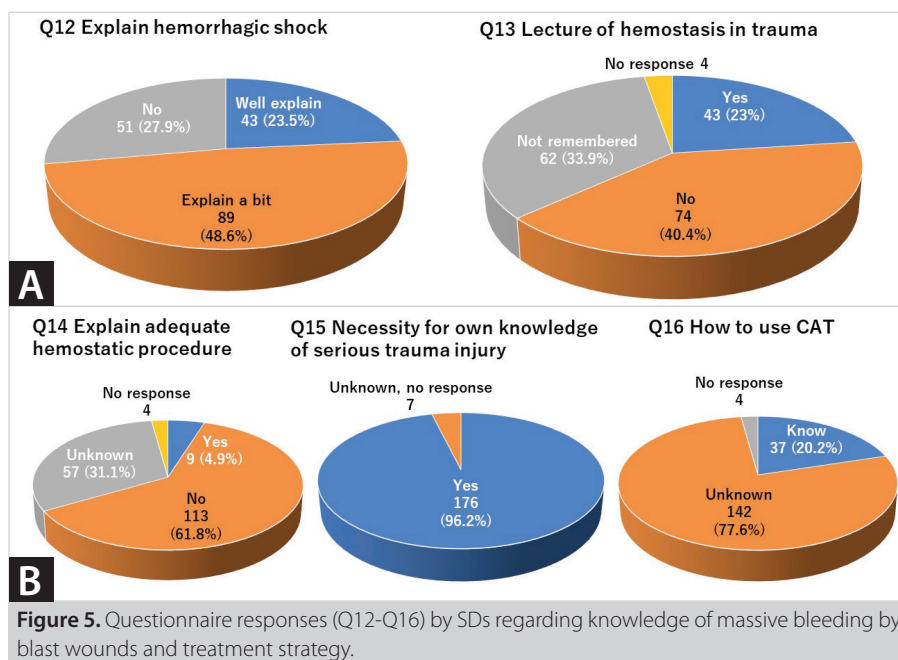
## DISCUSSION

Surgical education programs regarding trauma surgery have been increasingly reported worldwide in recent years (10,11). Adequate education, increasing the number of young surgeons, improving surgical techniques, and encouraging in-

structors among future generations may be beneficial for the field of surgery (12, 13). The importance of a systematic education system was not recognized in Japan two or three decades ago because the traditional apprentice system was used as the main method of education. As described above, most Japanese physicians are not currently concerned with MCIs; however, currently, explosives or guns can be purchased over the internet to conduct personal terror attacks in any region (<https://www.start.umd.edu>).

Surgical outcomes were monitored by our trauma team starting in 2012 at the time the department of emergency medicine began in our region, Miyazaki. The preventable trauma death





rate until 2019 was not dramatically decreased, but the organization and related awareness of surgeons regarding trauma surgery were gradually shaped by hard work (8). Some staff members can teach first-class instruction at the present. In fact, large disasters or mass casualties have not occurred previously, and traffic accident injuries are still the main cause of emergency operations. However, due to the globalization of tourism, our region and urban cities may also be influenced. Our land cannot maintain a single racial nation under the same culture as previous times. Based on experience with the 2019 Rugby World Cup and the planned 2020 Tokyo Olympic Games, our region is adequate for camp training; therefore, the possibility of worldwide terrorism or attacks is not low. However, the possibility of a disaster is always shared in the local media. In fact, however, awareness of blast injury incidents among young medical students, general surgeons and physicians is still low. Although we attempt to hold lectures on acute care surgery including trauma surgery, the rate of participation among all surgery curriculum is not high. Limited short lectures can be given to all medical students at this time.

Our 16 knowledge questions are not professional but seem to address popular topics among ordinary people from the United States government (14). Due to the classroom trauma, BLS and emergency medicine lectures before clinical examinations, the present results revealed that the knowledge, definition and concept of triage in mass-casualty incidents might be known among the majority of SDs. However, most SDs did not recognize an actual target of a blast injury in an MCI. A soft target in an MCI usually means private or civilian buildings or places in which an unspecified large number of people gather such as

restaurants, hotels, halls, parks, roads, and etc. (15). Therefore, urgent medical treatments tend to be late for survivors who have serious wound injuries, and adequate primary treatment of the surrounding civilians is required to save lives. In the next step, physicians or co-medical persons tend to encounter primary medical care until an ER specialist or trauma surgeon treats patients. All doctors or co-medical staff have to possess basic knowledge and training including that on cardio-pulmonary resuscitation. This knowledge of complicated world affairs must be emphasized in preclinical lectures. It is very difficult to understand the mechanism of gunshot or bomb wounds for Japanese individuals because of their limited experiences; therefore, SDs' low interests are understandable. A few coauthors had some experience treating gunshot wounds and no experience treating bomb wounds in Japan. In 2020, the American College of Surgeons held a web seminar regarding blast injuries in Lebanon, which was very useful to understanding primary care and problems via the graphic video (<https://www.facs.org/International/webinar/mass-casualty-management>). The introduction of such an international webinar may provide more knowledge for many physicians. With respect to triage in MCIs, the present results showed that the understanding of SDs was almost satisfactory. As some SDs considered systemic resuscitation first in awake injured persons, triage in any case pattern should be discussed in lectures. SDs had already completed hemorrhagic shock in animal practice in the second and third year grades; however, one-third did not have adequate knowledge on it. As we do not have enough lesson time for general surgical remarks, a combined lecture with physiology is necessary to solve the time limits in the modern era of medical schools (8,9). To

understand the hemostatic procedures of blast surgery, dry laboratory training (16) or animal laboratories are now scheduled while in medical school at our institute. Defibrillators has been fully spread in our country, but few of hemostatic tourniquet installations have been established, although both installations had been already spread in the USA after the Boston terror attack in 2013 (17). At our institute, only the department of ER has established this system at the present. The latest webinar lecture by Dr. J. Doucet, US San Diego Health trauma surgery, is also important to know the latest system (<https://www.youtube.com/watch?v=mhBe7Q6mH3U>). The hemostatic tourniquet technique can be applied using a man's ratchet belt according to our idea.

The goal of the present study in our project MANGO is to improve the knowledge and practical skills of young surgeons in general; however, it is too late to start when they select their specialty. Thus, it is important to begin training and education since medical students are in higher grades. The limitations of this study include a limited period of curriculum system of surgery, a lack of validation set analysis after the questionnaire and reevaluation of the instruction by the staff. Based on this pilot study, we will instruct actual dry and wet laboratory training, which was indicated in the latter of the results. In the next step, by implementing novel instruction, an additional questionnaire for both the fifth and sixth grade SDs and the internship doctors who answered these 16 questions will be scheduled.

## CONCLUSION

We reported the results of our questionnaire survey on blast injuries for medical students with the title of student doctor conducted between 2018 and 2019. By providing classroom lectures before clinical examinations, primary treatment in mass casualty incidents was almost recognized. However, the problem of understanding rare blast wounds and knowledge of hemostatic procedures remained limited. To motivate students or internship doctors to become trauma surgeons, improved educational systems, including instruction in surgical techniques or international webinar lectures led by expert surgeons, are needed in order to prepare doctors for unexpected blast injuries from disasters or terror attacks, even in regional academic institutions.

**Ethics Committee Approval:** The ethical approval for this study was obtained from Local Ethics Committee (Date: 13.11.2017, Decision No: C-0049).

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Author Contributions: Concept - F.K.; Design - K.N.; Supervision - A.N.; Materials - S.M., K.T., M.I.; Data Collection and/or Processing - S.M., F.K.; Analysis and/or Interpretation - F.K.; Literature Search - A.N.; Writing Manuscript - F.K.; Critical Reviews - K.F.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Financial Disclosure:** The authors declared that this study has received no financial support

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### ORJİNAL ÇALIŞMA-ÖZET

Turk J Surg 2022; 38 (1): 74-80

## Japonya'daki yerel bir tıp fakültesinde doktor adaylarının patlamaya bağlı yaralanmalar hakkındaki bilgi düzeyleri üzerine bir anket çalışması

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### ÖZET

**Giriş ve Amaç:** Bu çalışmanın amacı, tıp öğrencisi doktorların veya cerrahların patlama kaynaklı yaralanmalar hakkındaki bilgilerini geliştirmekti. Bu modern fakat belirsizliklerle dolu çağda, tıp fakültesi öğrencisi doktor adayları veya cerrahlar için patlamaya bağlı yaralanmalar üzerine eğitim ve öğretim programlarının yürütülmesi son zamanlarda dünya çapında gerekli hale gelmiştir.

**Gereç ve Yöntem:** Travma eğitimi müfredatının iyileştirilmesine sebep olan patlama kaynaklı yaralanmalarda birincil tedavi becerisini anlamak amacıyla 2018 ve 2019 yılları arasında bir bilgi anketi kullanılarak geriye dönük bir çalışma yapıldı. Çalışmanın katılımcılarının sahip olduğu unvan Doktor Adayı (DA) idi.

**Bulgular:** On altı sorudan oluşan anketi yanıtlayan 183 katılımcının cevapları özetlendi. DA'ların çoğunun travma tıbbi için temel dersler almasına ve çoğunluğunun kitle zayıfatı ile sonuçlanan eylemler ve birincil tedavi hakkında bilgi sahibi olmasına rağmen, yumuşak hedefler hakkında bilginin varlığı sınırlıdır. DA'ların dörtte biri patlama kaynaklı yaralanmaların özelliklerini biliyordu. Çoğu DA, hayat kurtarmak için hemostazlı bir uzuvdan aşırı kanaması olan bilinci açık bir kişi için öncelikli triyajın ne olduğunu biliyordu. Yüzde 17'lik bir kesim ilk olarak kardiyopulmoner resüsitasyonu seçti ve %72'si hemorajik şokun açıklamasını yapabiliyordu; ancak, sadece dördü yeterli hemostatik prosedürleri açıklayabildi. Çoğu DA, ciddi patlama kaynaklı travmatik yaraların tedavisi ile ilgili bilgilerini artırmaya merak duymuyordu.

**Sonuç:** Tıp fakültesindeki eğitim aşamalarından travma cerrahisi eğitimi konusunda deneyim ve otoritelerden alınacak eğitimler, öğrencilerin beklenmedik ciddi patlama kaynaklı travmalar hakkındaki bilgilerini artırmak için önemlidir.

**Anahtar Kelimeler:** Cerrahi eğitim, tıp fakültesi, tıp öğrencisi doktorlar, patlamaya bağlı yaralanmalar, travma ekibi

**DOI:** 10.47717/turkjsurg.2022.5537