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ORIGINAL ARTICLE

The Operating Room management for emergency Surgical Activity (ORSA) study: a WSES international survey

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Abstract

Background Despite advances and improvements in the management of surgical patients, emergency and trauma surgery is associated with high morbidity and mortality. This may be due in part to delays in definitive surgical management in the operating room (OR). There is a lack of studies focused on OR prioritization and resource allocation in emergency surgery. The Operating Room management for emergency Surgical Activity (ORSA) study was conceived to assess the management of operating theatres and resources from a global perspective among expert international acute care surgeons.

Method The ORSA study was conceived as an international web survey. The questionnaire was composed of 23 multiple-choice and open questions. Data were collected over 3 months. Participation in the survey was voluntary and anonymous.

Results One hundred forty-seven emergency and acute care surgeons answered the questionnaire; the response rate was 58.8%. The majority of the participants come from Europe. One hundred nineteen surgeons (81%; 119/147) declared to have at least one emergency OR in their hospital; for the other 20/147 surgeons (13.6%), there is not a dedicated emergency operating room. Forty-six (68/147)% of the surgeons use the elective OR to perform emergency procedures during the day. The planning of an emergency surgical procedure is done by phone by 70% (104/147) of the surgeons.

Conclusions There is no dedicated emergency OR in the majority of hospitals internationally. Elective surgical procedures are usually postponed or even cancelled to perform emergency surgery. It is a priority to validate an effective universal triaging and scheduling system to allocate emergency surgical procedures. The new Timing in Acute Care Surgery (TACS) was recently proposed and validated by a Delphi consensus as a clear and reproducible triage tool to timely perform an emergency surgical procedure according to the clinical severity of the surgical disease. The new TACS needs to be prospectively validated in clinical practice. Logistics have to be assessed using a multi-disciplinary approach to improve patients' safety, optimise the use of resources, and decrease costs.

Keywords Triage · Health system · Operating room · Management · Emergency surgery · Trauma surgery · Scheduling · Planning

Abbreviations

ORSA	Operating room surgical activity
OR	Operating room
WSES	World Society of Emergency Surgery

Background

Emergency surgery procedures represent a critical function of hospitals all over the world, and the burden of emergency surgical diseases is increasing. The annual case rate (1290 of 100,000) is higher than the sum of all new cancer diagnoses [1]. Despite advances and improvements in the management of surgical patients, emergency and trauma surgery is associated with high morbidity and mortality rate. This is attributed at least in part to delays in the access to definitive surgical treatment for acute surgical conditions [2].

The members of "The ORSA Collaborative" are given in Acknowledgements.

Extended author information available on the last page of the article

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There is a correlation between a protracted timeframe, including emergency department admission, diagnosis and surgeon's management and the risk of postoperative complications and healthcare costs [3–5].

Moreover, the COVID-19 pandemic imposed additional logistical constraints on the effectiveness of operating room (OR) management and utilization [3, 4].

Triaging, planning, and performing an urgent surgical procedure without delay became challenging because the healthcare systems were stressed, and the hospitals need to decrease costs and improve financial assets, keeping a high standard of care for all patients, both in elective and in emergency settings.

Assessing the root causes of delays in emergency department admission and access to the OR for emergency general surgery is crucial to improve patient outcomes and a hospital's overall level of quality of care.

The OR scheduling process is a complex task because urgent and emergent operations are unplanned and unpredictable, imposing conflicting priorities among surgical specialties and preferences of stakeholders, and limited resources available. High-quality hospital care includes scheduling emergency surgery as quickly as possible, efficient use of operating theatres' resources using standardized triaging of patients and surgical procedures, and implementing organizational models to avoid improvisation.

Two main triage classifications have been proposed to deal with the delay in accessing the OR [6, 7]: (1) The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) [6] classification of intervention which includes four categories of priority: immediate, urgent, expedited, and elective. The main limitation of this tool is the inaccuracy in appropriately timing surgery. It is not clear the allowed delay in hours for taking patients to the theatre according to class; (2) The Timing in Acute Care Surgery (TACS) classification [7], which divides patients into five colour-coded categories—red: immediate or extreme urgent surgery, orange: surgery within an hour from diagnosis, yellow: surgery within 6 h from diagnosis, green: surgery within 12 h, and blue: surgery within 48 h from booking the operation [7].

The new TACS was proposed and validated in 2023 [8] to improve the triage of emergency surgical patients according to the severity of the surgical disease (Table 1).

Most hospitals have OR organizational systems designed for their own needs which are not standardized. To the best of our knowledge, in clinical surgical practice, there is no uniformity in the management of ORs among hospitals and countries, nor is there a validated and reproducible available triage system for planning and scheduling emergency surgical procedures, during the day and night.

There is a lack of studies focused on the management of surgical activity in the emergency setting concerning triage, scheduling and access to the OR of the standardized and validated system of scheduling. For a better understanding of the phenomenon, we conducted the OR management for

Table 1 The new TACS classification

Color-Code class	Ideal Time to Surgery (ITTS)	Clinical scenario	Surgical diseases
RED	Immediate surgery	*Hemodynamic instability and vascular compromise*	blunt and penetrating trauma; postoperative hemorrhage; post-partum hemorrhage; other gynecological bleedings (unstable patient); ruptured aneurysm
ORANGE	Surgery preferably within 1 hour	*Hemodynamic stability after target rapid resuscitation, patient at high risk to become unstable, with signs of septic shock, peritonitis*	acute mesenteric ischemia; strangulated abdominal wall hernia with bowel ischemia; acute limbs ischemia; testicular torsion; ovarian torsion with ovarian ischemia; acute bleeding not amenable of angioembolization; retained placenta with acute bleeding; gastro-intestinal perforation; infected pancreatitis with shock; Fournier's gangrene; toxic megacolon; anastomotic dehiscence; necrotizing fascitis; ruptured tubo-ovarian abscess with septic shock; complicated appendicitis (necrotic, appendicular abscess, perforated, presence of fecolith) associated with local/generalized peritonitis; complicated diverticulitis (with local/generalized peritonitis and sign of septic shock-Hinchey III-IV); incomplete abortion; abscesses with septic shock
YELLOW	Surgery preferably within 6 hours	*Hemodynamic stability, patient at high risk to develop a multi-organ failure, with signs of sepsis*	contaminated open fracture; spinal cord compression with cauda equina syndrome; Fournier's gangrene; toxic megacolon; necrotizing fascitis; gastro-intestinal perforation; ruptured tubo-ovarian abscess; complicated appendicitis (necrotic, appendicular abscess, perforated, in presence of fecolith and sign of sepsis); complicated diverticulitis with sepsis (Hinchey III-IV); urolithiasis with sepsis; incomplete abortion with sepsis; abscesses with sepsis; compartment syndrome (any districts); gangrenous cholecystitis; infected pancreatitis with sepsis
GREEN	Surgery preferably within 12 hours	*Patient presenting local disorder with mild (reversible) organ dysfunction at high risk of developing a systemic disease*	appendicitis; thoracic empyema
BLUE	Surgery preferably within 24-48 hours	*Patient presenting a local disorder with mild (reversible)organ dysfunction with low risk of developing a systemic disease*	2nd look laparotomy; cholecystectomy after ERCP for stones migration or recurrent biliary colic; abscesses; cholecystitis; pelvic trauma fixation
WHITE (Organizational needs)	Preferably within 2-4 days	*Scheduling surgical procedures cancelled and urgent diagnostic procedures, within a week*	diagnostic biopsy/laparoscopy for urgent oncologic evaluation; elective postponed short interventions not amenable of elective rescheduling

The new TACS classification

emergency surgical activity (ORSA) snap-shot survey to collect qualitative data about the management of ORs for emergency surgery.

Methods

The "Operating Rooms management for emergency Surgical Activity" (ORSA) study represents an international web-based survey designed to assess the prevalent managing strategies for improving access and resource allocation in the ORs for emergency surgery patients on a global scale.

The ORSA study was endorsed by the World Society of Emergency Surgery (WSES).

The ORSA questionnaire was conceived and designed to collect qualitative data about the management of emergency surgical activity among the WSES international members [Online Appendix-2: the ORSA questionnaire].

The questionnaire was designed on a Google form platform and includes 23 multiple-choice and open questions divided into five sections: (1) OR departments logistics: Questions 1–4; (2) Triage and planning emergency surgical activities: Questions 5–8; (3) Type of hospital and workload: Questions 9–14; (4) Management of OR access: Questions 15–21; and (5) Demographic anonymous data: Questions 22–23.

The invitation to join the survey and the link to the questionnaire was sent by mail to a selected WSES members' list and kept on the society's website for 3 months. A reminder to participate was sent every month. Participation in the survey was free and voluntary and data were collected anonymously. Data were reported according to CHERRIES [9] and the available literature focused on the performance and the management of ORs to decrease delays was reviewed and discussed.

Results

One hundred and forty-seven WSES emergency and acute care surgeons answered the questionnaire. The response rate was 58.8% (147/250).

Countries' representatives are summarized in Table 2; most of the answers came from Europe, in particular, 31.9% (47/147) of responders worked in Italy. There is an average of 15 ORs for surgical departments (range 12–58) and at least 2.6 ORs (range 0–12) are dedicated to emergencies. One hundred and nineteen surgeons (81%; 119/147) stated to have at least one emergency OR in their hospital; while for the other 20/147 surgeons (13.6%), there is not a dedicated emergency OR. On average, there is 1.8 emergency OR for a hospital (range 0–11). There was major variation in the operating time schedule internationally reflecting the variation of the working hours globally (Figs. 1, 2, 3 and 4). Concerning the planning of an emergency surgical procedure, 70% (104/147) of surgeons used to plan emergency surgical procedures by phone call as it is summarized in Fig. 5. A color-coded triage system is implemented to prioritize a surgical pathology to surgery for 34% (50/147) of surgeons.

The emergency OR is always available for 87.1 (128/147) % of surgeons, only in the afternoon (2–8 pm) for 10.9 (16/147)% of surgeons, only at 8 pm–8 am for 6.1 (9/147) % of surgeons, in the morning (8 am–2 pm) 3.4 (5/147)% of surgeons (Fig. 6). In most of the hospitals, elective surgical procedures were postponed or canceled to perform emergency surgery, in fact, 46.3 (68/147) % of surgeons use elective OR to perform emergency procedures during the day (Fig. 7).

According to the type of hospital and beds availability, most of the participants in the survey work in an academic multidisciplinary hospital (58.4%; 45/77) that is also a level I trauma center (49.4%; 38/77) (Figs. 8, 9), with on average of 666 beds (range 35–2200).

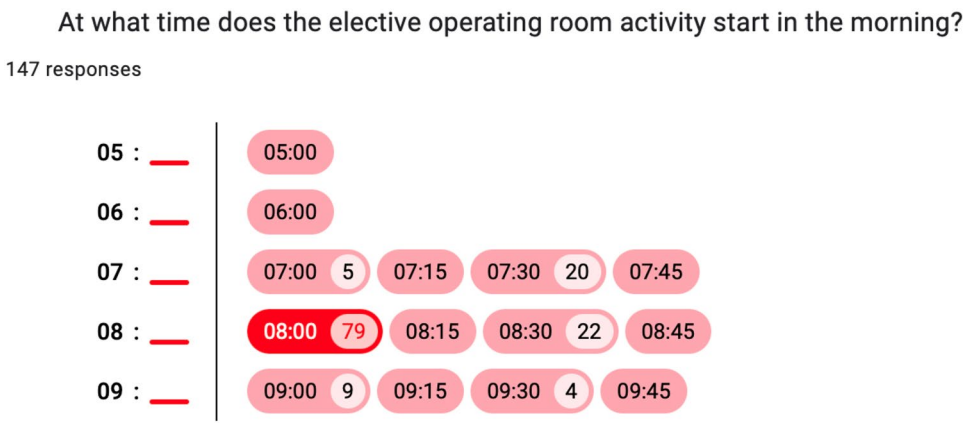


Fig. 1 Elective surgical activity times/ starting in the morning

Table 2 Countries' representatives

Countries (37)	N. Responders (147)	%
Italy	47/147	31.9
Greece	19/147	12.9
US	6/147	4
Germany	4/147	2.7
Romania	6/147	4
India	4/147	2.7
Spain	7/147	4.7
UK	5/147	3.4
Malaysia	2/147	1.3
South Africa	1/147	0.6
Belarus	2/147	1.3
Finland	2/147	1.3
Australia	2/147	1.3
Turkey	6/147	4
Brazil	1/147	0.6
Netherlands	1/147	0.6
Nigeria	2/147	1.3
France	3/147	2
Ireland	1/147	0.6
Israel	1/147	0.6
Argentina	1/147	0.6
Singapore	2/147	1.3
China	1/147	0.6
Croatia	1/147	0.6
Mexico	1/147	0.6
Sudan	1/147	0.6
Albania	1/147	0.6
Senegal	1/147	0.6
Benin	1/147	0.6
United Arab Emirates	1/147	0.6
Saudi Arabia	3/147	2
Norway	1/147	0.6
Bulgaria	3/147	2
Russia	2/147	1.3
Ukraine	2/147	1.3
Serbia	1/147	0.6
Egypt	2/147	1.3

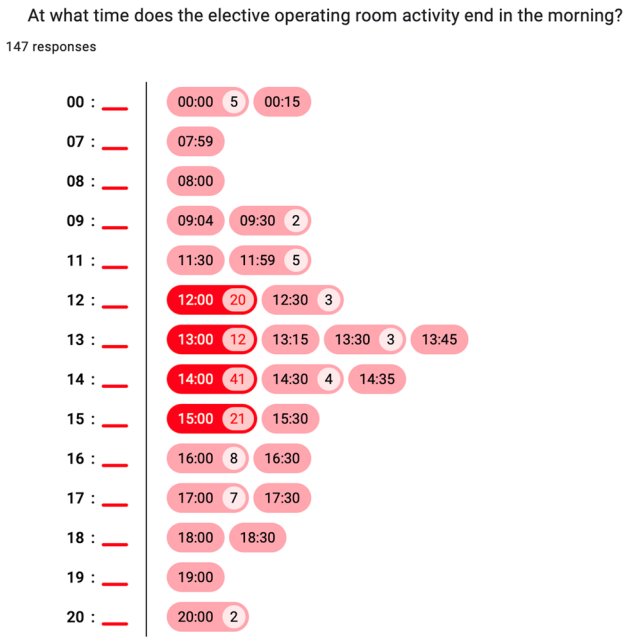


Fig. 2 Elective surgical activity times/ ending in the morning

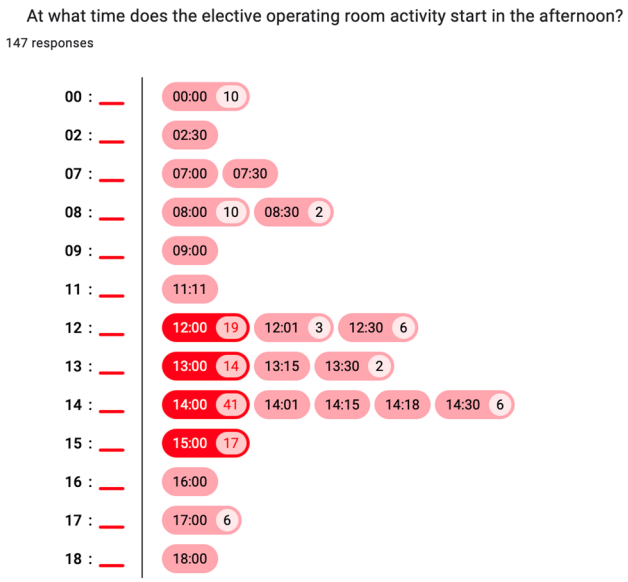


Fig. 3 Elective surgical activity times/ starting in the afternoon

The emergency surgical team is composed on average of 13 general surgeons (range 0–60).

The anesthesiology team is composed of an average of 17 anesthesiologists (range 0–80).

The OR access and planning are managed by the anesthesiologist for 61.9% (91/147) of responders (Fig. 10). On average of 1657 (range 25–48,000) emergency surgical procedures were performed in 1 year. The checklist is used to decrease errors in OR for 79.6% (117/147) of surgeons.

Discussion

The management of surgical patients, both in elective and emergency settings depends mostly on planning and scheduling surgical procedures, to decrease cancelations and delays in treatment and negative outcomes. Timely operating rooms availability is one of the most important parameters of hospitals' quality of care.

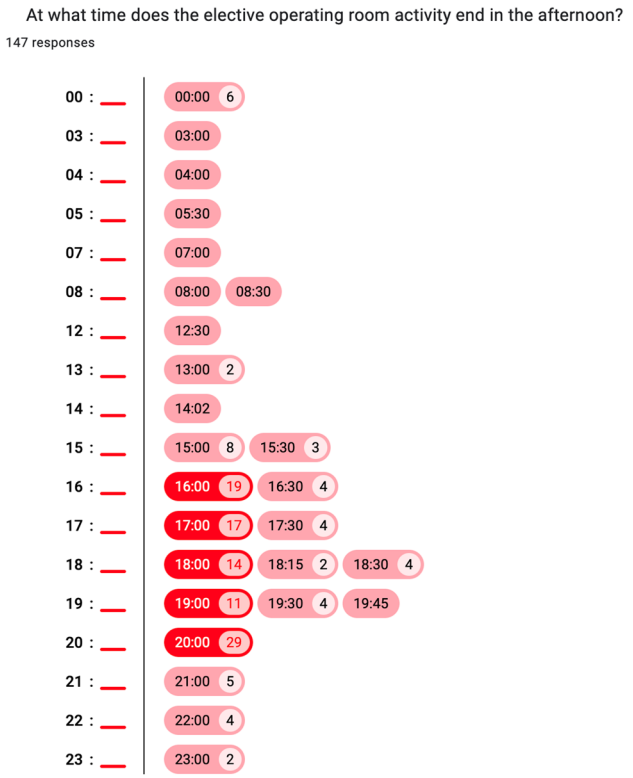


Fig. 4 Elective surgical activity times/ ending in the afternoon

The COVID-19 pandemic revealed the unpreparedness of healthcare systems facing a global pandemic and showed us how important it is to implement an effective triage of surgical patients and an efficient system of OR management.

Nowadays, we are dealing with an increased number of elective surgical procedures canceled or postponed because of organizational resources issues.

The 2015 Lancet Commission on Global Surgery and COVIDsurg Collaborative recently developed the surgical preparedness index (SPI) as a tool for hospital-level assessment and strengthening in decreasing backlogs in scheduling elective surgery according to 23 indicators across four domains: facilities and consumables, staffing, prioritization, and systems [10]. Scheduling surgeries under limited competing resources is a very complex process for managers and healthcare systems at the limit of resilience.

Most hospitals deal with emergency surgeries by reserving some OR capacity. This is possible in three main basic methods [11]: (1) dedicating an entire OR to emergency surgeries, it means that an emergency patient is operated on immediately if the emergency OR is available, but if the emergency OR is occupied, they have to wait until the ongoing surgery has finished; (2) scheduling the emergency surgeries in one of the elective ORs. In clinical practice emergency patient will undergo surgery once an ongoing elective surgery has finished; this method is called "break-in-moments"; (3) combination of 1 and 2 which means that the emergency patient is operated on immediately if the emergency OR is empty. Otherwise, the patient must wait until the emergency OR or one of the elective ORs becomes available. Scheduling operations in the ORs under limited logistical and human resources such as surgical and nursing staff, anesthesiologists, medical equipment, and recovery beds in surgical and intensive care unit (ICU) wards is a complex process with an increased cancelation rate of elective surgical procedures that need to be re-planned while managing severe cases as emergency.

A well-designed scheduling system should be concerned with the welfare of the entire system by: (1) effective usage of the ORs, (2) satisfaction of surgeons, (3) patients, (4) and OR staff, (5) simple and easy scheduling, (6) effective usage of post-anaesthesia care unit beds, and (7) low cancellation rate of elective cases [12].

Surgeons of all specialties claim a well-designed and clear methodology in planning and scheduling surgery to keep allocating the available resources in an efficient and effective manner, resulting in decreasing negative outcomes due to delays in the surgical treatment of an urgent pathological condition.

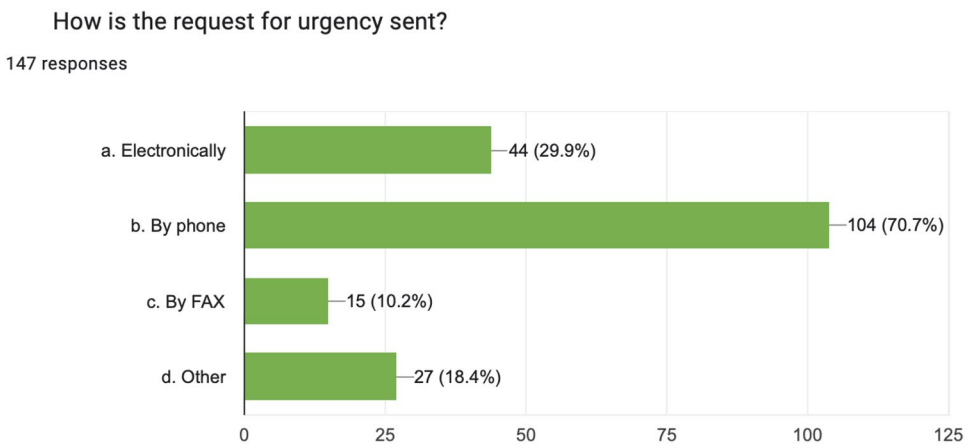


Fig. 5 Modalities of planning an emergency surgical procedure (communication)

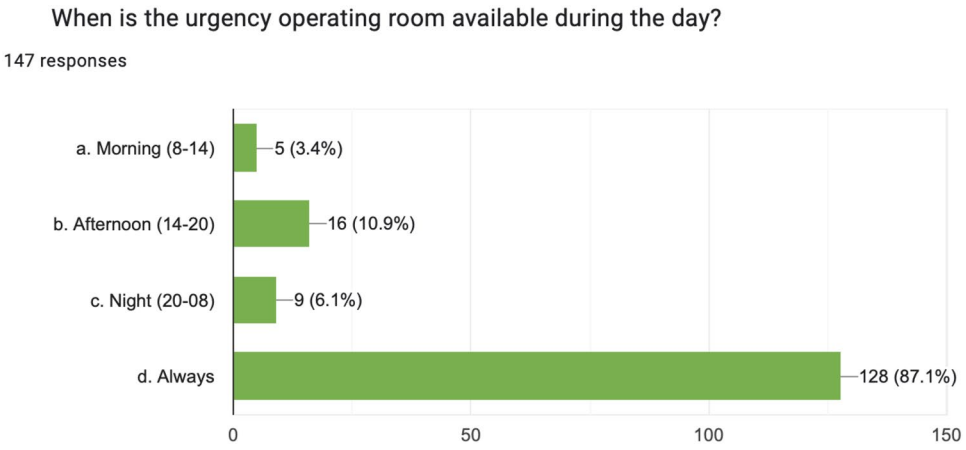


Fig. 6 Availability of dedicated emergency operating room

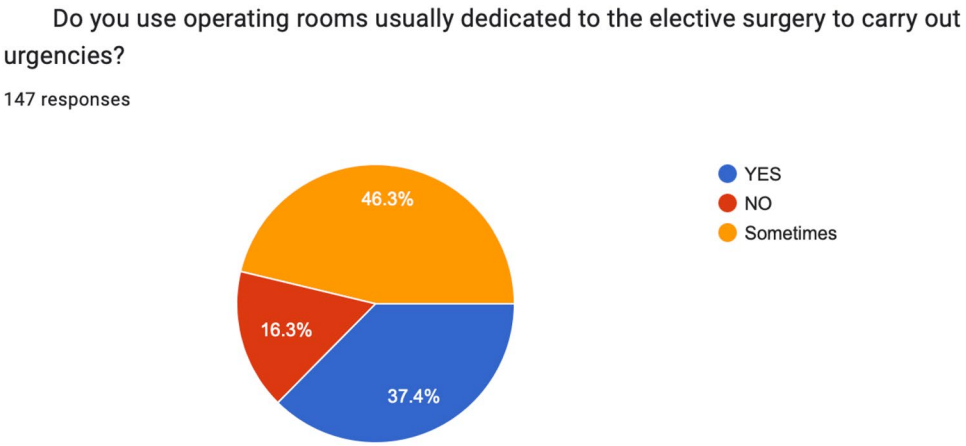


Fig. 7 Elective operating room and emergency surgical activity: conflicting scheduling

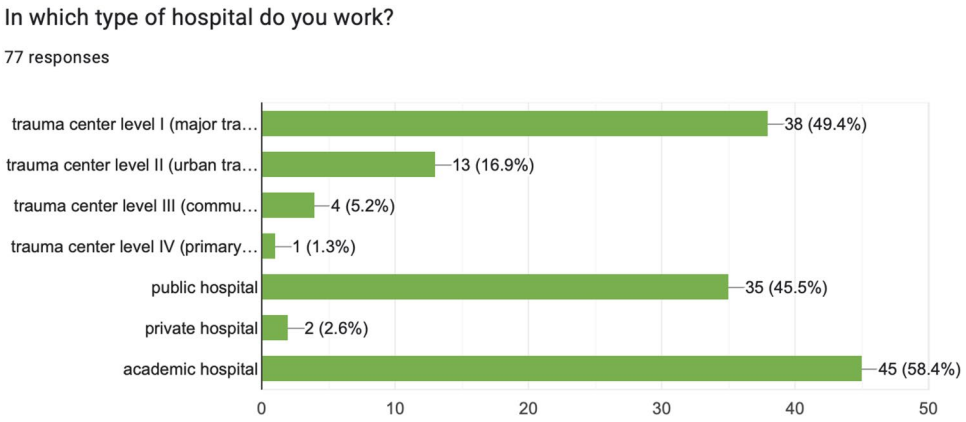


Fig. 8 Working hospital (participants)

Moreover, health managers should add to their tasks anticipating the increasing demand for surgical management caused by the ageing population, re-planning cancelled elective procedures and unplanned, more severe surgical emergencies.

These factors stress the need for the urgent development of an adequate, efficient, and cost-effective system for triaging surgical patients and scheduling procedures.

Since the first waves of the COVID-19 pandemic, the TACS classification has been proposed as a valid tool for triaging emergency surgical patients, operating planning, and access to OR [13, 14].

The new TACS classification is a comprehensive, simple, clear, and reproducible colour-code triage system that can be used to assess the severity of the patient and the surgical disease, reduce the time to access the OR, and manage

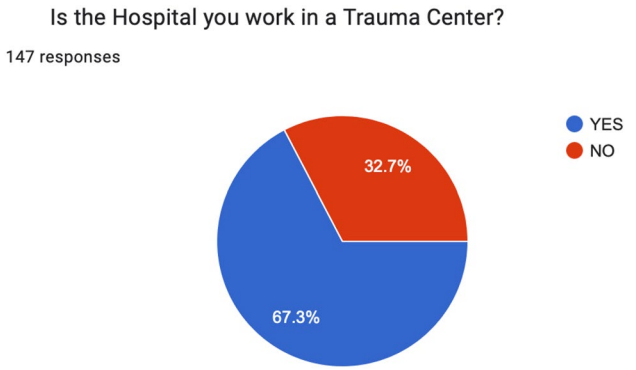


Fig. 9 Type of working hospital (participants)

the emergency surgical patients within a "safe" timeframe. Its implementation could improve communication among surgeons, between surgeons and anaesthesiologists and decrease conflicts, waste and waiting time in accessing the OR [8]. It was validated by a consensus of experienced emergency and trauma surgeons, internationally.

A prospective multicenter study is required to validate it in clinical practice.

The ORSA study reported data about the current management of ORs for emergency surgical procedures from a global perspective.

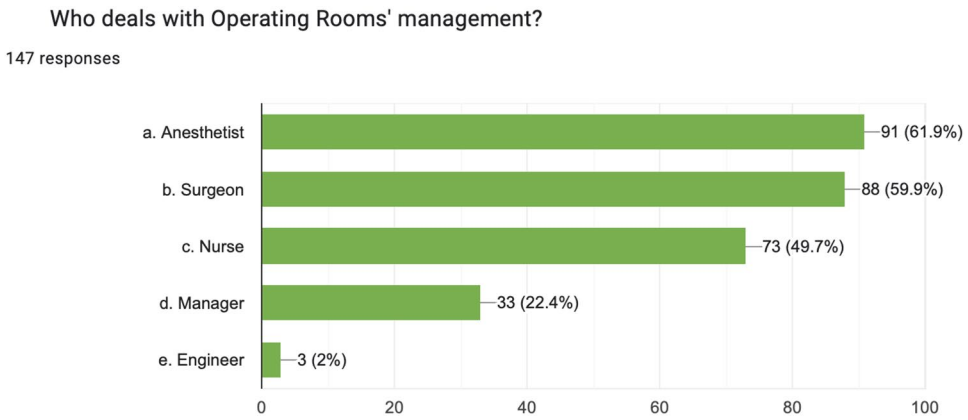
Our data confirmed that a colour-code triage system is implemented for over 50% of responders such as an intuitive and valid tool in practice, but the evident limit is established timing for surgery according to diseases and patient's clinical status.

The ORSA survey showed that there is at least one OR dedicated to emergency in each hospital; however, 46% of surgeons use the elective OR to perform emergency surgical procedures in the day. Moreover, according to the concept of "Break-in-Moments" (BIMs), emergency surgical procedures are performed when elective surgeries are completed or when the emergency OR becomes available [15]. Wulling et al. showed that managing emergencies in elective ORs led to an improvement in waiting times for emergency surgery from 74 to 8 min; working overtime was decreased by 20%, and overall OR utilization is increased by 3% [16]. Scheduling emergency cases among elective surgeries could result in prolonged waiting time for emergency surgery and delays the management or cancels the elective cases, according to the patient's hemodynamic status and severity of the surgical disease. Heng et al. evaluated the benefits to dispose an emergency OR. They reported that in a large children's hospital, when there is an emergency OR available, a significant decrease in elective procedures cancelations (1.5% v. 0.7%, $p < 0.001$) and an accumulated decrease of 5211 min in overtime minutes in elective rooms [17]. Van Veen-Berkx [16] analyzed data on 467,522 surgical cases performed in three university medical centers and reported that after closing the dedicated emergency OR, utilization slightly increased; overtime also increased. Hospitals which maintained a dedicated emergency OR, showed a higher increase in utilization and a decrease in overtime, along with a smaller ratio of case cancelations due to emergencies. A well-designed schedule should be concerned with the welfare of the entire system by allocating the available resources efficiently and effectively.

It was reported that crucial measurements in evaluating the quality performance of ORs are [18]: (1) The waiting time for surgery; (2) The OR utilization (under-utilization and over-utilization); (3) The number of patients deferred, refused or canceled in a determined period. The scheduling of urgent surgical cases should include: (1) Performing the cases in a sequence that minimizes the average waiting time for surgeons and patients; (2) Performing the cases in the order that they were presented; (3) Performing the cases based on medical priority, as established by an OR director or surgeons discussing the cases among themselves [20].

Off-line scheduling should consider reserving time for emergency surgeries to minimize overtime and maximize OR utilization, decreasing waiting time, or providing sequencing elective surgeries such that the overtime caused by elective surgery with a longer duration than expected is minimized [16]. Dexter et al. [21] consider the problem of

Fig. 10 Surgical activities management: who does deal with this?



scheduling emergency surgeries on the operational online level (on the day of surgery), by determining how and in which order the arriving emergency surgery should be inserted into the elective schedule or whether moving the last surgery of the day to another OR could decrease overtime labour costs.

Furthermore, they [22] proposed 4 priorities on which an OR management decision for changing the OR schedule should be based, that are: (1) patient's safety; (2) a surgical procedure can only be canceled if the patient's safety is not endangered; (3) minimize overtime; (4) reduce patient waiting time.

In daily practice, the list of emergency surgical procedures is compiled in an extemporized manner. Planning is typically based on improvisation and negotiation, due to the uncertainty of emergency patients and the experience of the OR manager, appointed for the day. There is high variability in the number of ORs reported and OR block time management (starting and end-time of surgical elective activity) [20]. Cumulated delays in elective cases will increase the waiting time for emergency surgery. Usually, surgical activity starts at 8 a.m. in many hospitals to maximize OR utilization. The timelines of starting and ending elective surgical activities depend on many factors including an appropriately booked schedule that starts on time, ends on time, has correct case times and quick turnovers. In an academic pediatric hospital, the most common reasons for the delay were the surgeon's and anaesthesiologist's unavailability, and the lack of preparedness of patients [23].

It is not so easy to identify single responsibilities because assessing factors implicated in the chain of cumulating delays in managing emergency surgical cases is complex and concerns first-case start-time accuracy, case duration accuracy, average turnover time, and off-hours elective surgery. Costs increased according to ORs underutilization, because of same-day cancelations, unplanned OR closures and excess staffing costs.

According to the ORSA data, an anaesthetist is often responsible for checking planning and scheduling elective and emergency surgical procedures. Surgeons present their urgent cases to an anesthetist by phone. To our knowledge, there are no studies investigating the safety of this modality of communication and if it could increase delay, queues of patients waiting for an unplanned surgery and errors in prioritizing surgical procedures. Communication by phone could be ineffective in planning emergency surgical procedures because it is not trackable and can result in tensions, misunderstandings and enormous delays in the management of emergency surgical patients.

We did not collect data about when surgical emergency procedures are mostly performed during the day or delays cumulated with the schedule method implemented in their hospitals.

The decision on scheduling elective patients can be made at a strategic level (case mix planning problem) when OR times are assigned among different surgical services; in a tactical way or according to a master surgical schedule (MSS) that defines the number and type of available ORs; or at an operational level which is concerned with the scheduling of elective patients on a daily basis after an MSS has been developed [24].

Simply, scheduling decisions should be made according to the type (date, time, room, and capacity) and level (discipline, surgeon, and patient) of a decision being made [19].

The scheduling of emergency surgery is based on: (1) Clinical decision-making; and (2) Logistical factors such as staff availability, resources, and patient factors. In emergency and trauma settings, clinical decision-making focuses on minimizing risks; it is rational, deductive, and evidence-based. The emergency surgeon has a crucial role in this. The anesthetist is the intermediary between surgeons and OR nurses/managers. Conflicts and controversies occur due to a misalignment of individual objectives and contribute to delaying surgery and increasing the emergency waiting list.

A key factor is lack of incentives for anesthesiologists and nurses; whereas surgeons must get the work done for patient safety.

Logistical factors could delay emergency surgery and lead to elective procedures cancelations; they include waiting for staff, for OR availability, for elective surgery to finish, for instruments, for ward or ICU beds, for patient's transport, for surgical preparation to be completed, and for patient's documentations and investigations.

According to our data, an average of 1657 emergency surgical procedures could be performed in 1 year. This number reflects a surgeon's opinion based on a personal prediction and not on demographic data. ORSA data showed that an emergency surgical team is composed on average of 13 general surgeons and an anesthesiology team is composed on average of 17 anesthesiologists: the adequacy of these numbers will depend on the type of hospital, bed availability, and workload.

In the end, teamwork is essential to fulfill all surgical daily tasks. The number of surgeons has to be sufficient to safely manage elective and unplanned cases in operating theaters, ward and ICU patients, and patients admitted to the emergency department. Good teamwork depends on leadership and coordination of all surgeons by sharing knowledge and understanding each other's role, to establish an open environment between and within the various professionals aiming is to provide proper patient's care. [25, 26].

If the acute care surgeon on call is busy performing an emergency surgical procedure, a qualified backup surgeon who has been previously designated, can provide the needing to timely manage an incoming emergency surgical patient

[https://www.facs.org/about-acs/statements/statements-on-principles/].

The checklist is an important tool to decrease errors in OR. It has been implemented in surgical practice of 79.6% (117/147) of surgeons in ORSA study. The WHO surgical checklist was introduced in 2008 [27] to standardize processes of clinical practice, build team working and improve communication. It brings the full operating team together at critical time points during the surgical pathway in the operating theatre to ensure patient safety.

The checklist has three good practice stages: (1) sign in before administration of anesthesia; (2) timeout immediately before the surgical incision; and (3) sign out at the end of the operation before the patient is removed from the operating theatre. It has been implemented slowly in clinical practice. Major barriers to its adoption were poor communication, lack of leadership, inappropriate timing for checking an item, time taken up by checklist completion, and difficulty in identifying the role and responsibility of each staff member [28]. The surgical checklist does not impact surgery starting time in elective and emergency settings. If adopted, complications decrease from 18.7 to 11.7% (36%) and mortality from 3.7 to 1.4% (62%) [29].

Limitations of the study

This study aimed to have a global perspective on issues related to the increased rate of cancellations and delays in operating room (OR) access, especially for emergency and urgent surgical procedures. For this purpose, it was conceived as a web survey and distributed to WSES international members who are interested in emergency surgery activity. The response rate reflects the participation of only highly interested academic experienced acute care surgeons. Data are mostly from high and middle-income countries while data from low-income countries are suboptimal.

Conclusions

There is no dedicated emergency OR in the majority of hospitals internationally.

Elective surgical procedures are usually postponed or even canceled to perform emergency surgery. It is a priority to validate an effective universal triaging and scheduling system to allocate emergency surgical procedures such as the new TACS proposed by the WSES. Logistics have to be assessed using a multi-disciplinary approach to improve patients' safety, optimal use of resources, and decreasing costs. This will enable us to be more prepared for disaster, pandemics and mass casualty situations.

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