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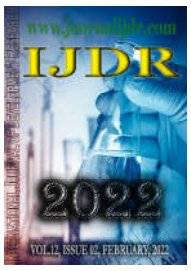

RESEARCH ARTICLE OPEN ACCESS

SEVERE HEMORRHAGE HANDLING PROTOCOL: USE OF INTRAOPERATIVE BLOOD RECOVERY IN THE EMERGENCY TRAUMA SETTING

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ABSTRACT

Describe the process of construction and validation of the Protocol for the Management and Handling of Severe Hemorrhage in Trauma, combined with the technique of Intraoperative Blood Recovery in an emergency scenario, by Trauma Nurses, in patients with thoracoabdominal trauma and risk of shock. Methodological study based on the Appraisal of Guidelines for Research & Evaluation, in two stages: narrative review for content construction; construct validation by a panel of judges Nurses and Physicians who are experts in Emergency, Anesthesiology, Hemotherapy and Surgery, using a factor analysis by Pearson's Coefficient of Variation and homogeneity of the opinions of the judges. Ethical aspects were respected under opinion Nº. 2,685,577. It was evident as the content of the Protocol: Phases of the Protocol; Nursing Diagnoses and Interventions; Recommendations and procedures for Intraoperative Blood Recovery; role of the Trauma Nurse in managing the MHEG Protocol. It was identified that all domains evaluated showed suitability above the proposed, scoring above 91%. All judges responded that they would recommend the use of the Protocol. It is concluded that the Protocol was considered valid with broad agreement on its applicability as a technology for assistance care management in the handling of severe hemorrhage in multisystem trauma.

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INTRODUCTION

Trauma is considered a public health problem, with hemorrhagic shock being the most common cause of hospital death in trauma patients (ATLS, 2018). In view of this, the quick, safe, and effective recognition in the emergency unit, in view of this type of clinical situation, is vital for the beginning of preventive measures for the shock evolution. The implementation of strategies for handling severe hemorrhage, the bleeding control and treatment of trauma coagulopathy are fundamentals (NAEMT, 2017; NAEMT, 2018). A recent study points to the need for research to analyze the triggering factors of massive transfusion, highlighting the importance of obtaining a common action protocol for health professionals work in the emergency area (Estebaranz-Santamaría *et al*., 2018).

The implementation of a Mass Transfusion Protocol (PTM) in trauma care services aims to reduce morbidity and mortality (NAEMT, 2018). In a reference hospital in the care of trauma victims in the northeast region of Brazil, a transfusion committee has had, since 2017, a Massive Transfusion Protocol for patients with visible or suspected severe bleeding. The role of the Nurse in processes in the coordination of the hemotherapy service and in the clinical scenario of severe bleeding, as well as the effective participation in the Hospital Transfusion Committee (CTH) provided an opportunity to create a group of Nurses called: Trauma Nurses, as well as the performance of these professionals in the Intraoperative Blood Recovery (RIOS) technique, together with the surgical team, in the care of patients with thoracoabdominal trauma (Nascimento *et al*., 2021).

It is known that nursing care must be systematized in all environments where professional nursing care occurs (COFEN, 2009), organizing the entire operation of the Nursing Process (NP), in a systematic and dynamic way in the care provided to patients. In the emergency scenario in severe situations due to hemorrhage injuries, it is possible to identify the real needs and potential health problems of the patient in order to clinically judge and point out possible Nursing Diagnoses (NDs), such as the Risk of shock, which is considered the most frequent in the clinical reality of severe hemorrhage, in order to bring from the Nurse, interventions and the achievement of the expected results for problem solving (NANDA-I, 2018; NIC, 2016; NOC, 2016). The NDs allow the choice for Nursing interventions in care practice, determined the complexity of the clinical picture and subsequently the type of intervention with a focus on quality and patient safety. Given the above, it is justified and relevant to use a valid health technology that brings a targeted approach to the management and handling of severe hemorrhage in trauma, to minimize the complications of shock and/or the risk of shock. The objective was to build and validate the Management and Handling Protocol for Severe Hemorrhage in Trauma (MHEG), combined with the RIOS technique by Trauma Nurses, in patients with thoracoabdominal trauma and risk of shock.

MATERIALS AND METHODS

This is a methodological research on protocol development and validation. The phases for conducting the research were: 1) narrative review to build the content and 2) construct validation by panel of judges. A tertiary hospital, a reference in the care of trauma patients in the Municipality of Fortaleza-CE, Brazil was chosen for the research. Figure 2 show the Flowchart of RIOS Indication in thoracoabdominal trauma. It is noteworthy that authorization was requested from the Dr. José Frota Hospital (IJF) to present the Flowchart (Figure 2), as well as a quote from this Health Institution.

Phase 1) The inclusion criteria established for the studies were as follows: articles available electronically in Portuguese, English, and Spanish, establishing a time frame in the period from 2005 to 2019. Studies in editorial formats and articles outside the established period were excluded, with a total of 13 studies. The use of advisory panels, books, resolutions, ordinances, guidelines, and specific international journal of publications was also taken as evidence for the elaboration of the Protocol, in addition to free search in the Protocol's construction, totaling 64 productions. For the first stage, the productions were located between June and July/2019, with the crossings of the following Descriptors in Health Sciences (DECS) and the Medical Subject Headings (MeSH): Clinical Protocols, Multiple Trauma; Blood transfusion; Validation Studies; Hemorrhagic Shock, at COCHRANE (38); National Library of Medicine/National Institutes of Health (11); Latin American and Caribbean Literature on Health Sciences (1) and Nursing Database (0).

The Protocol included the NANDA-International Nursing Classification Systems (NANDA-I), Nursing Intervention Classification-NIC, and Nursing Outcomes Classification-NOC (NANDA-I, 2018; NIC, 2016; NOC, 2016). The "GRADE System (Grades of Recommendation, Assessment, Development and Assessment) was used to determine the quality of evidence and level of recommendation (BRASIL, 2015). Phase 2) The study population included expert judges in the following themes: Urgency and Emergency; Pre-Hospital Care, Hemotherapy and Surgery. For the second stage of Protocol Validation, there were a total of 15 invited judges, nine accepted and returned the Informed Consent Form (TCLE). Eight made up the panel of judges, the ninth judge was chosen to participate in the research as a Hemotherapist, however he presented himself as an Emergency Doctor, and it was not possible to characterize the information passed on. Following standards (Jasper, 1994) described to support the quality criteria for the choice of judges, there were four physicians and four nurses. These professionals worked in Urgency/Emergency, working in Pre-Hospital Care (APH), Hemotherapy, Anesthesiology and Surgery. Of the eight judges, three participants had specialization in Urgency and Emergency and another three in Hemotherapy. We had a judge with residency in general surgery, residency in digestive tract surgery, and residency in liver transplantation, and a judge with residency and a doctorate in anesthesiology. Each judge responded to an electronic form and made their general assessment of the protocol using the Appraisal of Guidelines for Research & Evaluation (AGREE) instrument, with data analysis performed through the adequacy calculation proposed by the AGREE II itself (Brouwers *et al*, 2010). It should be noted that the Revised Standards for Quality Improvement Reporting Excellence (SQUIRE 2.0) was used as an instrument for checking the study (Ogrinc *et al*., 2015). Each of the six domains of the AGREE II calculates a quality score. To assess the protocol, the judges analyzed the protocol and scored on a Likert scale (1 to 7) (Brouwers *et al*, 2009; Agree Collaboration, 2003). The domain that achieved a score equal to or greater than 75% was established as "satisfactory quality", a percentage that means a minimum acceptable performance in the assessments in general (Sousa *et al*, 2018). Pearson's Coefficient of Variation was calculated (Brasil *et al* 2018).

To preserve the identity of the participants, the answers were assigned a numerical code, namely: J1, J2, (...), J8, as recommended by Resolution 466/2012 (BRASIL, 2012), with the approval of the Research Ethics Committee No. 2,685,577.

RESULTS

Figure 1 presents items from the MHEG Protocol, combined with the technique of Intraoperative Blood Recovery in patients with thoracoabdominal trauma and risk of shock, with the role of the Trauma Nurse elaborated from the first stage of the research. The assessment of the adequacy of the MHEG Protocol in Trauma was obtained using the AGREE II domains. When evaluating, it is identified that all domains scored above 91%. Each item in the protocol domains was given a space for the judges to comment on their answers.

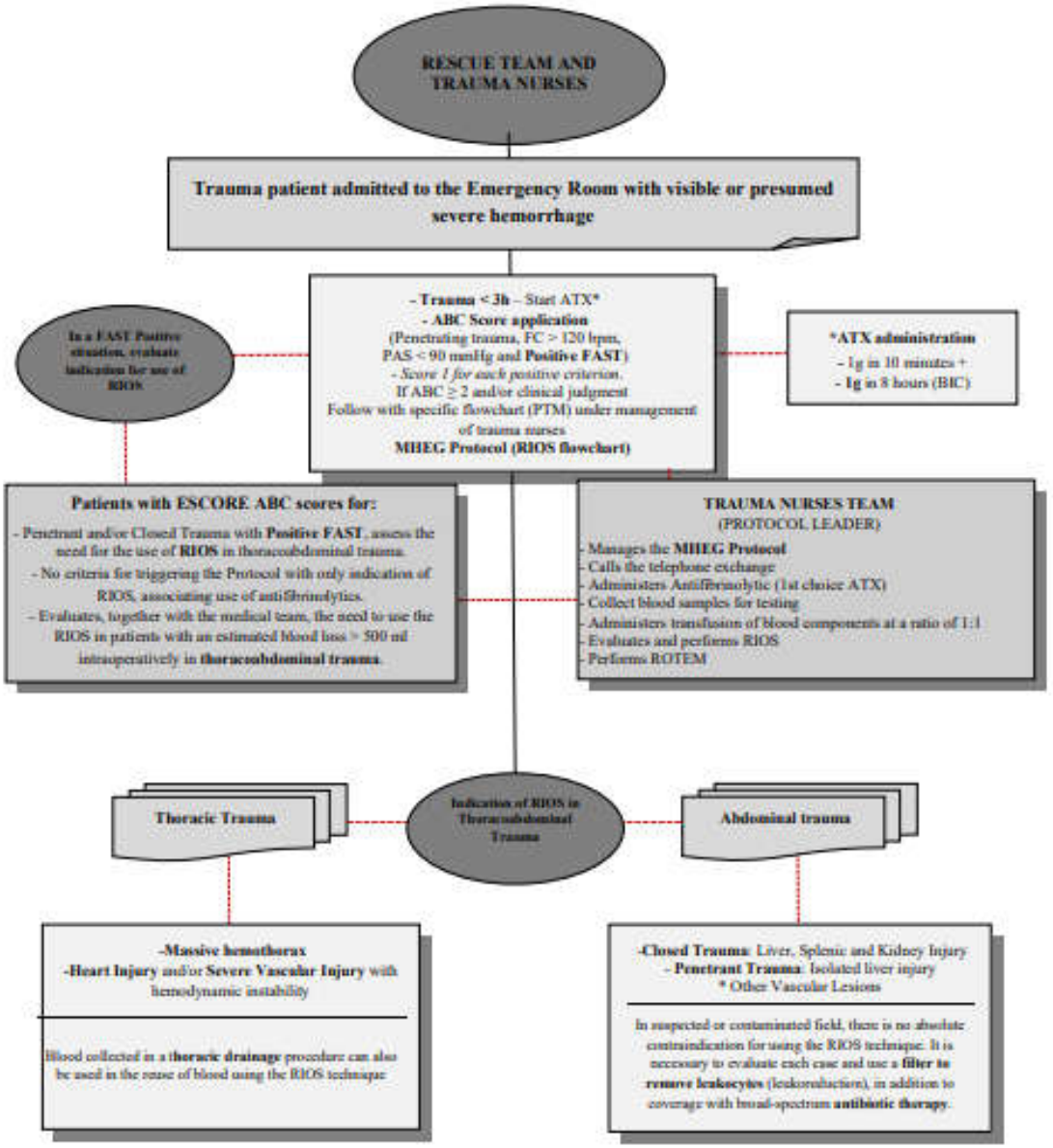
Figure 1 - Items covered in the MHEG Protocol, Fortaleza, CE, Brazil, 2019.

Risk of Shock (NANDA-I*, NOC† and NIC‡) NANDA-I, 2018; NOC, 2016; NIC, 2016	Approach and Management Map	Criteria for reusing blood in thoracic drainage (DT) with closed system
- Identification of patients at risk and classification of the Nursing Diagnosis - Risk of Shock. - Assessment and measurement of the actual occurrence of the diagnosis and severity of hypovolemic/hemorrhagic shock. **Nursing Outcomes - NOC:** - Detection and control of risks; - Circulatory and respiratory status; - Severity of blood loss, hypotension and infection; - Reaction to blood transfusion; - Control and detection of risk; - Immediate postoperative surgical recovery; - Vital signs **Nursing Interventions - NIC:** - Administration of blood components and blood products; - Control of hypovolemia; - Control of allergies; - Infection control; - Water control; - Risk identification; - Monitoring of vital signs; - Oxygen therapy; - Prevention of shock; - Hemodynamic regulation; - Volume replacement; - Supervision.	- Role of the Multiprofessional Team in the initial care of the patient; - Trauma Nurse: Leader in Protocol management. **- MHEG Protocol Management:** - Monitoring of all patients included in the protocol during the first 24 hours, identifying the risks associated with coagulopathies and reducing trigger failures; - Optimization of the use of antifibrinolytics. **- Blood conservation strategies using RIOS in urgent and emergency care:** - Indication of using the RIOS technique in the initial care of patients at risk of hemorrhagic shock and in need of massive transfusion in thoracoabdominal trauma. **- Laboratory monitoring including Rotational Thromboelastometry:** - Monitoring of patients with severe bleeding, minimizing the number of patients without laboratory monitoring.	- Complete the Checklist Form for the use of RIOS in DT to be performed by the Nurse, evaluating the indication for using the technique; - Implements Nursing care throughout the autotransfusion process, ensuring the correct identification of the patient, monitoring, assessment of vital signs, maintenance of venous access for administration of intravenous solutions and transfusion of other blood components, if necessary. - Prepares DT and RIOS material. - Connects the RIOS suction system with the chest drain. - Measures vital signs (Blood Pressure, Heart Rate, Temperature and $SatO^2$) of the patient. Monitor the results of laboratory tests before and after the DT procedure using the RIOS technique and record the entire procedure in the patient's medical record. **Items contemplated for use by RIOS in DT:** - Assembly of the closed system in DT; - Preparation of the surgeon in the field with the trauma nurses; - Collection and processing of aspirated blood; - Infusion of recovered autologous red blood cells.

*NANDA International Nursing Diagnoses; †Nursing Interventions Classification; ‡Nursing Outcomes Classification.

Regarding the main recommendations described by the expert judges, it can be highlighted, in table 1, that they were accepted, as five of the six domains evaluated in the protocol received the Person Coefficient of Variation (CVP) between 0.7 and 1,0, being classified as strong according to the recommendations of scholars, such as: CVP = 0.10 to 0.30 (weak); CVP = 0.40 to 0.6 (moderate); CVP = 0.70 to 1 (strong) (Brasil *et al*., 2018; Dancey, Reidy, 2006). Only domain 3, called Rigor of Development, received a CVP of 0.62, classified as moderate, and only J3 recognized the study's limitations due to lack of access to paid evidence; even so, the other judges highlighted the

Figure 2 – Flowchart of the MHEG Protocol with indication of the RIOS technique in trauma Fortaleza, CE, Brazil, 2019.



Caption: MHEG: Management of Severe Bleeding, **ABC:** Assessment of Blood Consumption or Assessment of Blood Consumption, **ATX:** Tranexamic Acid, **BIC:** Continuous Infusion Pump, **HR:** Heart Rate, **PAS:** Systolic Blood Pressure, **FAST:** Focused Assessment with Sonography for Trauma, **PTM:** Mass Transfusion Protocol; **RIOS:** Intraoperative Blood Recovery (Klein et al, 2018; Nunez et al., 2009; National Institute for Health and Care Excellence, 2015; ATLS, 2018).

Table 1 - Pearson's coefficient values by domain of the AGREE II and the judges' recommendations, Fortaleza, CE, Brazil, 2018.

Domain	CVP*	Recommendations/Judges
Scope and purpose (D1)	0,77	- Remove and Modify Objectives (J6); Inclusion of questions about the rational and well-managed use of blood products (J3).
Stakeholder involvement (D2)	0,76	- No recommendations.
Developmental rigor (D3)	0,62	- A limitation of access to paid evidence was highlighted (J3).
Clarity of presentation (D4)	0,76	- No recommendations.
Applicability (D5)	0,77	- Consider costs (J3); Trauma nurses are already sensitive to use (J5, J6); Professional training/qualification (J1, J5, J6, J8).
Editorial independence (D6)	0,76	- No recommendations

*CVP: Pearson's Coefficient of Variation value (-1 to +1).
Source: Authors (2019).

use of the GRADE system (Brasil, 2015), the level of evidence widely used, demonstrating the high scientific rigor of the Protocol. As for the resource implications arising from the application of the MHEG Protocol in Trauma, the judges highlighted: *Improvement of the care service for patients with severe hemorrhage* (J7); *These are accessible resources for the hospital service and that are part of the routine of highly complex services, and they only must be organized to make the service more efficient* (J8). They reinforced the need to

seek homogeneity between the various care professions and the role of management so that they can adopt in the work process: It is a joint work to be effective, where one depends on the other (J4); *It is the role of hospital management to provide resources for adopting the protocol. They are critical patients, who will demand important investments and managers must provide/minimize material failures. A trauma center must have these resources* (J5). For the overall protocol assessment score determined by the eight judges, an average of 6.5 was obtained for domains 1, 3 and 5 and an average of 6.6 for domains 2, 4 and 6. To emphasize that 100% of the judges responded that they would recommend the use of the protocol. As they said: *Well-designed protocol, based on scientific evidence, with potential for practical application and benefits for the health system. (J3); Global assessment of high-quality clinical guideline, recommended and its use will be of great relevance in the evolution/prognosis of critically traumatized patients (J5); Very important guideline for clinical practice in the in-hospital care of trauma patients. Great potential for optimizing clinical approaches in the management of patients with severe hemorrhage and, consequently, saving many lives (J6).*

DISCUSSION

Professionals who work in the care of trauma patients must adopt guided behaviors, according to scientific evidence and validated by judges. International guidelines, such as Advanced Trauma Life Support® (ATLS®), Prehospital Trauma Life Support® (PHTLS®) and Advanced Trauma Care for Nurses® (ATCN®), are proposed to ensure a systematic assistance approach of trauma victims (Settervall *et al*., 2012). With this intention, the MHEG protocol was conceived as a care proposal in the care of multisystem trauma with risk of hemorrhagic shock and indication of RIOS in thoracoabdominal trauma, attended by the emergency unit, by the multidisciplinary team, favoring the management of procedures established in the care line. The fact that the domains evaluated in the AGREE have presented suitability above the proposed, scoring above 91%, and all the judges have responded that they would recommend the use of the protocol, infers the great potential for optimizing clinical approaches in the approach to patients with severe hemorrhage. One of the aspects to be highlighted regarding the AGREE domains were the comments and suggestions of the judges. Therefore, these qualitative assessments greatly contributed to the necessary changes in the protocol. As for the CVP, which provides the variation of the data obtained in relation to the average, high homogeneity in the opinions and scores attributed by the evaluators was evidenced (Polit, Beck, 2011).

Regarding the role of the Nurse, the care scenarios, where the Nursing process and classification systems can be applied, are diverse; therefore, some specificities need to be better explored (Bavaresco, Lucena, 2012). Through the MHEG Protocol, the identification of the NANDA-I nursing diagnosis was highlighted: "Risk of Shock", which is defined as susceptibility to inadequate blood flow to body tissues, which can lead to cellular dysfunction that threatens life, which can compromise health. Some of the associated conditions are Hypotension, hypovolemia, hypoxemia, and hypoxia (NANDA-I, 2018). From this ND, the protocol flow also included Nursing-NOC and Nursing Interventions-NIC results (NANDA-I, 2018; NIC, 2016; NOC, 2016). It is noteworthy that the RIOS technique was already in use in the Institution previously only in the elective scenario, being extended to the scenario of thoracoabdominal trauma in the emergency room (Nascimento *et al*., 2021). The use of this technology requires a multidisciplinary approach consisting of nurses, anesthesiologists, clinicians, and surgeons, among others. And its incorporation has demonstrated quick, effective decision-making for handling the shock in the face of trauma or any other need. The recognition of the need for RIOS for patients with thoracoabdominal trauma from the moment of their admission to the emergency room in a 24-hour regime, made possible, with the support of the Coordinating Blood Center - HEMOCE, the availability of two equipment for use in major surgeries in elective procedures and emergency care, although it is still possible to perform the procedure in the emergency room in thoracic drainage procedures, being the only hospital in the state of Ceará, between public and private, to have this technology on the assistance to the trauma ill. With the flow of the MHEG Protocol, it is also possible, in the initial assessment of emergency care, to decide on the indication of RIOS in thoracoabdominal trauma (Klein *et al*., 2018; Nunez *et al*., 2009; National Institute for Health and Care Excellence., 2015; ATLS, 2018), analyzing criteria established in the ABC Score present in institutional assessment protocol and emergency conducts.

Considering the above data, it should be noted that several strategies were used, since the beginning of the development of the MHEG Protocol, which provided subsidies for the different stages of construction by the interested parties, including meetings with members of the Hospital Transfusional Committee (CTH); Coordination of the Transfusion Center, Hospital Infection Control Commission (CCIH), experiences of other services, external reviewers, training, among others. As for the role of nurses, emergency transfusion care must be in accordance with the new Resolution 629 of 2020 of the Federal Council of Nursing (COFEN, 2020), stressing that "the care and assistance to patients who are victims of major trauma must be guided by protocol multidisciplinary evidence-based, with definition of responsibilities of all professionals involved in care, with the Nurse responsible for the care and monitoring of patients with severe bleeding as a member of the care team." The same Resolution mentions as one of the Nurse's competences: “Handling automated equipment for the collection of components, therapeutic procedures and intraoperative blood recovery” (COFEN, 2020). As the assessment and management of patients with signs of hemorrhagic shock is not only the nurse's responsibility, but the protocol was also validated by specialist nurses and physicians. The MHEG Protocol allows for the recognition of patients at risk, allows a multidisciplinary approach at admission and clinical assessment in the emergency room for the feasibility of using intraoperative blood recovery in patients with a surgical profile and potential benefit of using this blood conservation technique. The limitations of the present study, such as: temporal delimitation and lack of access to evidence as a restriction in the search for a narrative review.

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