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BARRIERS TO ADEQUATE TRAUMA PAIN MANAGEMENT AT THE EMERGENCY DEPARTMENTS OF PUBLIC TERTIARY REFERRAL HOSPITALS IN RWANDA

Dissertation submitted in partial fulfillment of the requirements for the award of Master of Medicine degree in Anesthesiology

By:

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DECLARATION AND AUTHORITY TO SUBMIT THE DISSERTATION

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Title of the project:

"BARRIERS TO ADEQUATE TRAUMA PAIN MANAGEMENT AT THE EMERGENCY DEPARTMENTS OF PUBLIC TERTIARY REFERRAL HOSPITALS IN RWANDA".

a. Declaration by the Student

I   do hereby declare that this *dissertation* submitted in partial fulfillment of the requirements for the degree of MASTERS **OF MEDICINE** in **ANESTHESIOLOGY** at the University of Rwanda/College of Medicine and Health Sciences, is my original work and has not previously been submitted elsewhere. Also, I do declare that a complete list of references is provided indicating all the sources of information quoted or cited. Date and Signature of the Student

Dr. HAGENIMANA Jean Pierre:

Signature: ⎯⎯⎯⎯⎯⎯ Date: August 22,2021

b. Authority to Submit the dissertation

In my capacity as a Supervisor, I do hereby authorize the student to submit his dissertation.

Prof. Paulin RUHATO BANGUTI

Signature: Date: Aug 22, 2021

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LIST OF SYMBOLS AND ACRONYMS

ACS: American College of Surgeons

APS: American Pain Society

CHEOPS: Children's Hospital of Eastern Ontario Pain Scale

CHUB: Centre Hospitalier Universitaire de Butare

CHUK: Centre Hospitalier Universitaire de Kigali

CMHS: College of Medicine and Health Sciences

ED(s): Emergency Department (s).

EMCC: Emergency Medicine and Critical Care

EPM: Essential Pain Management

FLACC: Faces, Arms, legs, cry, consolability

GCS: Glasgow Coma Scale

IRB: Institutional Review Board

NRS: Numerical Rating Scale

PCA: Patient controlled Analgesia

PI: Primary Investigator

ISS: Injury Severity score

RTA: Road traffic Accident

SOAP: Subjective, Objective, Assessment, Plan

SP02: Oxygen saturation

UR: University of Rwanda

USA: United States of America

VAS: Visual Analogue Scale

VRS: Verbal Rating Scale

WHO: World Health Organization

DEDICATION

To God the Almighty for His love and blessings,

To my Beloved wife, for her encouragement throughout this work,

To my Beloved Mother, Brothers and Sisters,

To my Friends and Relatives,

To my supervisors,

To my Patients

This piece of work is dedicated with great pleasure.

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ABSTRACT

Background: Pain control after trauma is an important and basic aspect of emergency management. Most patients at the Emergency Department (ED) commonly complain of pain, but many barriers prevent adequate assessment and treatment. Examples include level of staff education, availability of analgesics and lack of appropriate assessment tools. The use of guidelines and protocols to improve patient satisfaction is key to address trauma pain at the ED. In this study the impact of provider training in basic pain management on pain of trauma patients in the ED in two tertiary hospitals, was assessed.

Methods:

A pre and post intervention study was adopted: in the ED of the two main public referral hospitals in the country, the pre along with the post-intervention pain management data using a questionnaire were collected. The use of pain management protocols or guidelines, and perceptions of patients, physicians and nurses about barriers were also assessed.

The pre and post intervention study was used over a period of 6 months starting from September 2019 to April 2020 and consisted of 3 phases. **Phase I: Pre-intervention:** an observation of routine practice on pain assessment and management over a period of 2 months**; Phase II: Intervention**: Training and mentorship on the practicability of the WHO Pain Assessment and Management Ladder-based protocol and the ACS guideline for trauma pain management during 1 week; **Phase III: Post intervention:** Observation while using the guideline and protocol on pain assessment and management. We collected pre-intervention and post-intervention pain management data using a questionnaire. It assessed pain management practices and perceptions of patients, physicians and nurses about barriers.

Results: Over 6 months 309 participants were enrolled in the study. Of those participants,149 observed throughout the pre intervention phase and 160 participants during the post intervention one. In the pre intervention phase 94% of patients observed were males while in post intervention phase males represented 73%. The median age was 35 years (IQR [25-48]) years in both phases. The most used practiced in approach to pain control was cold packs **6**

(5%)[p< 0.001] in phase one, increasing up to **24(18%) [p<0.001]** in phase three. The majority of patients received morphine: **51 (41%) [p<0.001]** and **74 (54%) [p<0.001]** in phase one and phase three respectively.

Paracetamol was administered to **85 patients (69%) [p<0.001]** in phase I and **115 (84%) [p<0.001]** in phase III. Low VAS (mild-moderate) pain scores were present in **2(16%) [p<0.001]** pre- intervention vs **28(20%) [p<0.001]** in post intervention.

Staff listed multiple barriers to adequate pain assessment and treatment: inexperience,**9(36%) [p<0.010]** vs 15**(64.7) [p<0.010]** time constraints 8**(32%) [p<0.010] vs** 11**(47.4%)[p<0.010],** poor communication **19(76%) [p<0.010]** in pre-intervention vs **16 (69.4%) [p<0.010]** in post intervention. Documentation was occasionally: **17(68%) [p<0.001]** in pre vs **12(52%) [p<0.001]** in post-intervention. Patient satisfaction was improved by the intervention: from **43(24%) [p<0.001]** in pre-intervention vs **81(60%) [p<0.001]** in post intervention.

Conclusion: In CHUK and CHUB ED the adherence of patients and staff to pain management guidelines and protocol improved after education. This intervention improved the assessment of pain using the VAS Scale and the use of multiple types of treatments in combination, with different targets to pain management. Despite perceived barriers due to lack of experience and poor communication for ED staff, the overall satisfaction of patients was improved.

Key words: Pain, barriers, trauma patients, Emergency departments

CHAPTER I. INTRODUCTION

1.1.Background:

Different researchers have shown that control of pain is a crucial part of care in emergency settings (EDs). Although some local guidelines and protocols for pain management for ED use exist, still oligo-analgesia of trauma-related pain remains unfortunately common (1). In fact, the lack of optimal pain management approximately affects 80% of the global ED patient population and induces a serious problem in more than 150 countries (2)

Limited data regarding acute trauma pain management in the ED is available from low/middle income countries. Numerous factors can contribute to inadequate pain management. These include a lack in numbers and training of physicians and nurses, erratic supply of drugs and lack of patient education about the side effects associated with analgesic therapy: this lack of understanding can contribute to health care providers not following pain management protocols and guidelines (3).

This study aims to explore how patient barriers as well as personnel and institutional barriers affect the adequate control of post traumatic pain in the acute stage at EDs in a low/middle income setting. Practical solutions to reduce these challenges and manage pain more effectively were also investigated.

It was hypothesized that training and implementation of a protocol would improve pain management practices as defined by an improvement in pain scores. To test this hypothesis, trauma patients admitted to the EDs of the 2 main public referral hospitals of Rwanda (CHUK and CHUB) over a 6-month period were studied. As a secondary endpoint, perceived barriers that mitigated against the use of pain protocols and guidelines were also investigated.

1.2. Study objectives:

1.2.1. General Objective:

To improve the quality of pain management at the ED of two teaching hospitals in Rwanda (CHUK and CHUB).

1.2.2. Specific objectives:

- To evaluate if the implementation of the WHO pain ladder-based trauma pain management protocol and ACS guideline to acute trauma pain, can improve the quality of pain control at the emergency settings of two teaching hospitals (CHUK and CHUB).
- To evaluate the level of patients' satisfaction with acute trauma pain management
- To determine the perceived barriers of healthcare providers during the use of the WHO pain ladder-based trauma pain protocol and ACS guideline on acute trauma pain management use.

1.3. Research question and hypothesis:

Research question

Does the implementation of the WHO pain ladder-based trauma pain management protocol and ACS guideline for trauma pain, improve the quality of pain control at the emergency settings of two teaching hospitals in Rwanda?

- What are the perceived barriers of healthcare providers as well as patients against the use of the WHO pain ladder-based trauma pain management protocol and ACS guideline for trauma pain management?

Hypothesis

The implementation of the WHO pain ladder-based trauma pain management protocol and ACS guideline for trauma pain management improves quality of acute trauma pain management as defined by an improvement in pain scores at six months post implementation.

1.4. Rationale

A.   Pain protocols for trauma patients have never been implemented in Rwanda.

B.   Limited data exists regarding acute trauma pain management in Rwanda.

CHAPTER II. LITERATURE REVIEW

2.1. Theoretical Literature

There is a close correlation between acute pain and trauma, as painful stimuli are transmitted from the site of injury to the nociceptive system, which leads to pain sensation (4). It is also shown that pain is considered as the main concern of patients consulting at the emergency unit (5). Nevertheless, it has been shown to be mistreated in the ED (6). Some researchers have demonstrated the absence of evidence protocols for analgesia purpose to full acute pain control (10-13). Consequently, patients complain of unnecessary pain, thus physiological and psychological effects occur.

To ensure adequate pain control to patients with trauma, it is obvious that all ED personnel get alerted to use evidence-based knowledge and practices (7) (8).

Ensuring accurate and scheduled pain control to traumatized patients does not only concern their right but also has effect on their early healing, decreases patient's response to stress, impacts on hospital length of stay shortening, reduces costs, decreases risks to chronicity of the pain resulting from neuroplasticity, and obviously diminishes morbidity and mortality rates (9) (10).

Prevalence and incidence of pain in Emergency Departments:

Making reference to the World Health Organization (WHO) report, injury is considered as a front-line cause leading to death among males and females ranging between 15 to 44 years of age and would be rated the third-place leading cause of mortality and morbidity among various ages in 2020 (14).

It also has been shown that road traffic accidents (RTA) result in an estimated 50 million injuries, each year, all over the world (5).

Therefore, pain is also considered as a symptom among trauma patients, and very prevalent in ED settings. Still, ED nurses sometimes undermine the magnitude of somatic and visceral pain at

the rate of 95% of patients, consequently insufficiency of pain control is observed (14). It has been pointed out that above the rate of 78% of patients consulting emergency units deny painful sensations (4).

In one study 77% among 764 patients were assessed and found with pain while arriving in ED. The same study showed a higher chance of not being asked about pain, but this does not affect the percentage of patients asked about pain in consideration of age (15).

Order of actions recommended for traumatic pain control:

1. **Assessment of Pain:**

Similar to other conditions, pain history should be gathered through the following ways: on Onset, palliation, Quality, Radiation, Severity, and Time for pain (OPQRST) (16).

An important step is to document the pain assessment, in e.g.: a SOAP note format, so that it is clear that assessment occurred. Some validated tools to assess pain must be used for example Verbal Rating Scale (VRS) and Visual Analogue Scale (VAS).

A thorough history along with physical examination obviously prove the rationale in as far as analgesics prescriptions and the pain control plan are considered.

The awareness and attitude of patients regarding behavioral techniques for analgesia might be an influencing factor for full success of pain control (18).

Availability of appropriate nociception and painful scaling tools (validated tools) for assessment:

Numerous standardized unidimensional nociception and painful ladders have been invented to assess early stages of pain.

Most useful assessment tools with reference to ages:

Below 4 years of age and Adults with cognitive disorders: The choice of an observational scale is used for example:

❖ Children's Hospital of Eastern Ontario Pain Scale (CHEOPS). It consists of six categories (Cry, facial, verbal, torso, touch, legs), every category has 3-4 levels of care, with 4-13 Scores in total.

❖ Faces, Arms, Legs, Cry, Consolability (FLACC). Every category is scored from 0-2, resulting

in total between 0-10 scores. Zero showing relaxation and comfortability; 1-3 = Mild discomfort; 4-6 = Moderate pain, and 7-10 = Severe pain

Above 12 years of age: There is a choice of using a self-report scale such as:
❖ Visual Analogue Scale (VAS): For this scale, the patient indicates the amplitude of pain on a10- cm line.

❖ Numerical Rating Scale (NRS). For this scale, pain is scored from 0 to10.

❖ Verbal Rating Scale (VRS). For this scale, the patient indicates the pain on a Likert scale verbally.

2. **Medical/ non-medical intervention:**

Multimodal Techniques for Traumatic Pain Management:

Management starts with IV analgesic drugs to relieve pain using frequent intervals, low doses. To start with small doses allows the ED staff to figure out the required needs for patients in order to shift to long-acting analgesics or patient-controlled analgesia method. The drop of the blood pressure resulting from analgesics is commonly consequent to hypovolemia and assessment should be done to rule out massive hemorrhage which would need extensive resuscitation.

When pain is not practically fully alleviated, the approach using multimodal pain modalities consists of the provision of multiple analgesic drugs acting through different mechanisms which can suitably alleviate pain.

These analgesic medications may be provided by different routes or via the same route (18) (19). The common analgesic modalities used for traumatic pain control include the following ones but the list is not exhausted:

(1) Neuraxial blocks: spinal, epidural, caudal blocks;

(2) Controlled Analgesia to patients known as PCA, using systemic opioids;

(3) Peripheral nerve block procedures; for example, the intercostal blocks, intrapleural catheter, plexus blocks, and local anesthetic for incisions. To select the appropriate analgesic, the main assessment

score should be marked then follow the WHO Pain Ladder.

3. Re-assessment:

It is recommended that pain be regularly assessed and reassessed at interval of 5 minutes until controlled. Pain management should be timely assessed and re-assessed following different intervals.

2.2. Empirical Literature

Acute pain management protocols and guidelines at the ED have been proven to improve the quality of pain management, but only a few studies exist.

A pain management protocol using fentanyl to treat severe pain was implemented at a major trauma center in the Netherlands and this protocol was used by healthcare providers in improving pain management quality (20).

Another study done at Muhimbili hospital in Tanzania showed the success of implementing a protocol of pain assessment and management. It has been shown that when arriving at the ED, 310 (99.6%) patients underwent pain assessment and were documented while 285 (91.6%) had benefited the second assessment (21). The WHO guide pain ladder-based trauma pain management protocol has shown success in improving pain

Review and Research Gap identification

The material above evidences a big Knowledge gap with regard to data on acute trauma pain management in EDs. Limited data has also been noticed particularly on the use of standard protocol and guidelines in the setting of trauma pain. In addition to the results of the present study, this field may be deepened by the future researchers to show factors why the topic has been so sparsely investigated.

CHAPTER III. RESEARCH METHODOLOGY

3. 1. Study design:

This research is a pre- and post-intervention study that implemented a Traumatic Pain control protocol issued on base of the WHO Pain Ladder and ACS guideline for acute trauma pain management (appendix 2, 3) at both teaching hospitals (CHUK and CHUB) EDs.

3.2. Research approach and Data collection procedure

The approach of pre- and post intervention study was adopted. The index study was conducted in three phases. The subjects were staff (medical doctors and nurses) at the ED and patients who have sustained traumatic injuries admitted to the ED throughout the period of data collection.

At the start of the data collection process, medical students rotating at CHUK and CHUB were trained and mentored on the use of a predesigned questionnaire for one week.The study was carried out in a period of 6 months and subdivided into 3 phases:

Phase I: Pre-intervention.

During the first two months, trained medical students as data collectors carried out a survey on patients as well as on staff of the EDs, collecting baseline data about demographic characteristics, pain scores, implementation of pain assessment tools, the implication of pain management protocols and guidelines, multimodal pain management, pain management documentation and patient satisfaction with pain management.

Phase II: Intervention.

Both EDs staff (nurses and doctors) of CHUK and CHUB were trained and mentored on the use of traumatic pain management rooted from the WHO Pain Ladder and ACS guideline for acute trauma pain management for 1 week. WHO Trauma Pain Management Charts and materials of those tools were distributed to all participants.

The Traumatic Pain control protocol with the base on the WHO pain ladder has the following main items: Pain assessment (using VAS), acute pain treatment with corresponding regimen

modalities, and reassessment (Appendix 2). It was developed based on the WHO pain ladder which in turn was published in 1986. Nowadays all over the world, the consensus promotes with medical management purpose its use to all pain conditions whether associated with serious illness or from wounds (22).

Phase III: Post intervention

For the following period of six months after implementing the traumatic pain control protocol based on the WHO pain ladder and ACS guideline for early-stage traumatic pain management, ED doctors and nurses were observed while using the tool for pain management. Data was collected after implementation of the protocol of pain control based on the WHO pain ladder and the same variables as in the pre-intervention phase were recorded.

3. 3. Research setting:

The traumatic pain control protocol based on the WHO pain ladder and ACS guideline for acute trauma pain management were for the first time introduced in the EDs of CHUK and CHUB which serve as tertiary referral hospitals.

Both CHUK and CHUB, School of Medicine and Pharmacy are affiliated at the University of Rwanda. CHUK has around 513 beds and approximately a catchment area of more than 6,200,000 individuals (www.chuk.rw). CHUB is the only teaching hospital in the Southern Province of Rwanda. It has 500 beds and receives referrals from 15 district hospitals, and annual admissions of over 2,000 injured patients (www.chub.rw).

CHUK is situated in Kigali, the capital city, while CHUB is situated in Southern Province, Huye District. Both of them provide a wide range of health care services, involving anesthesia, emergency and critical care, internal Medicine, internal medicine, surgery, pediatrics, radiology, ophthalmology, dermatology, obstetrics/gynecology, and laboratory services.

The emergency departments have a total of 24 beds at the CHUK and 18 beds at the CHUB respectively. EDs approximately have 20,000 patient visits per year for CHUK (www.chuk.rw) and an annual admission of 2000 injured patients for CHUB respectively (www.chub.rw). EDs

are the locations which receive trauma patients at an early stage and hence patients often have pain.

At CHUK and CHUB EDs, pain protocols and guidelines are supposed to be followed by emergency medicine and critical care residents under supervision of EMCC physicians, general practitioner doctors and nurses. The ED staff is supposed to have enough experience because of exposure to treating acute traumatic pain as they are the primary attendings to the traumatized patients.

3. 4. Study population

3.4. 1. Selection of the study population

It has been shown that both CHUK and CHUB have a catch up area of more than 6.2 million people. Demographic characteristics of patients are composed of a mixture of rural and urban traits with a broad social demographic.

Inclusion criteria:

Traumatic Patients irrespective of the cause of trauma but with pain.

Patients more than 18 years (assent for those less than 21 years, others: consent)

Glasgow coma scale more than 10/15

Patients admitted in EDs for not more than 72 hours.

Exclusion criteria:

Deterioration of the level of consciousness after inclusion in the study with a GCS less than 10/15.

3. 5. Sample size:

We assumed that only 20% of patients in EDs at CHUK and CHUB received adequate pain management. We in addition supposed that 40% would receive adequate pain management after one week of workshop training of health care providers at EDs of CHUB and CHUK. To demonstrate this difference would have required a sample of 162 patients, 81 patients in pre and

81 in post intervention (power: 80%: alpha error: 0.05).

Given that ED of CHUB registers fewer patients than CHUK with a ratio of almost ½, we expected to enroll at least 27 patients from ED/CHUB and 54 patients from ED/CHUK. This could easily be accomplished within the planned time periods.

3.6. Validity and reliability of research instruments

A validated instrument for data collection "*APS* Patient Outcome Questionnaire *(APS POQ R)*" was explored to verify if the protocol *of traumatic pain control based on WHO pain ladder* and *ACS guideline for trauma pain management* (produced by American College of Surgeons) used for intervention helped to successfully achieve our study objectives.

3.7. Data Collection

Data collection was performed using a preset questionnaire. The process of data collection was assumed by medical students who were rotating at EDs during the period of data collection and those data collectors had to gather data from traumatic patients no later than 72 hrs. after admission to ED with acute pain. The ED staff received the questionnaire and had to tick the letter corresponding to the correct answer according to his/her perception.

3. 8. Data processing and Statistical analysis

Data processing and statistical analysis were done using the statistics software SPSS version 21. The chi-square test for normally distributed data, was used to compare categorical variables of the pain management between the two periods (pre and post intervention periods) and statistical significance was set at $p < 0.05$.

Barriers perceived by health care professionals in two EDs, were expressed as percentages into two groups (pre and post intervention periods).

3.9. Ethical considerations

Ethical issues:

1. An ethical approval has been obtained from the IRB of the University of Rwanda, College of Medicine and Health Sciences (IRB No 204/CMHS IRB/2019).
2. Ethical approvals have been obtained from the University Teaching Hospitals of Kigali, ethics committee No. EC/CHUK/113/2019 and Butare No. CHUB/DG/SA/09.1407/2019 for conducting data collection in their respective Emergency departments.

Data confidentiality:

The data was taken respecting participants' confidentiality and to ensure the last one, we used electronic password-protected documents. Hard copies will be kept for 5 years in a locked file and after this time hard copies will be discarded. Only the PI has access to this data.

CHAPTER IV. RESULTS

4.1. Introduction

In total, 261 patients whose pain scores were reported during the study period, all after consenting to participate in the research, all participants enrolled were both from CHUK and CHUB. Of those enrolled, 124 (47.5%) patients' pain scores were recorded during phase I (pre-intervention) and 137 (52.5%) patients' pain scores were reported during phase III (post-intervention phase). A total of forty-eight (48) ED staff also participated in the study after having consented. Of those 48, 25 (52%) were enrolled in pre-intervention phase and 23 (48%) participated in phase three (post-intervention).

4.2. Presentation of findings:

Table 1. **Patients' demographic characteristics and their pain reported scores**

	Pre-intervention N=124 Frequency (n) (%)	Post intervention N=137 Frequency (n) (%)	Median [IQR]	P value
Age groups (years)				p<0.001
≤ 5	0	10 (7%)		
6-10	0	10 (7%)		
11-20	6 (5%)	12 (9%)		
21-30	41 (33%)	22 (16%)		
31-40	34 (27%)	23 (17%)		
41-50	26 (21%)	19 (14%)		
51-60	10 (8%)	13 (9%)		
61-70	1 (1%)	17 (12%)		
71-80	6 (5%)	3 (2%)		
≥ 81	0	8 (6%)		
Median (IQR) age, years			35[25-48]	
Gender				
Male	94 (76%)	100 (73%)		
Female	30 (24%)	37 (27%)		
Patients' pain score				p<0.001
0	72 (58%)	33 (24%)		
1	18 (15%)	30 (22%)		
2	20 (16%)	28 (20%)		
3	8 (6%)	28 (20%)		
4	4 (3%)	9 (7%)		
5	0	4 (3%)		
6	1 (1%)	3 (2%)		
7	1 (1%)	2 (1%)		
8	0	0		
9	0	0		
10	0	0		

Table: 1. shows both patients' demographic characteristics and pain scores in both pre and post intervention periods. Most patients were young, with a Median age of 35 [25-48]. In addition, the majority were male in the pre as well as the post intervention phases of the study. Pain scores reported by patients were recorded during the two phases of the study. Majority of patients had mild to moderate pain; 16% in phase I vs 28% phase III participants scored VAS 2. 6% in phase I vs 28% in phase III scored VAS 3 and 3% in phase I vs 7% in phase II participants scored VAS4.

Table 2. Presentation of used analgesic options/modalities in the ED

	Pre-intervention Intervention N=124 Frequency(n)(%)	Post N=137 Frequency (n)(%)	P value
Non-pharmacological analgesia **p<0,001**			
Cold pack	6(5%)	24(18%)	
Talking to friends and relatives	1(1%)	0	
Distractions	0	2 (1.5%)	
Imagery	1(1%)	1(0.7%)	
Massage	1(1%)	0	
Prayer	4(3%)	5 (4%)	
Relaxation	0	1 (0.7%)	
Friends and relatives	0	3 (2%)	
Talking to medical staff	2(1.6%)	20 (15%)	
Pharmacological analgesia **p<0,001**			
Opioids			
Fentanyl	2 (1.6%)	1(0.7%)	
Morphine	51 (41%)	74 (54%)	
Morphine + Pethidine	1 (1%)	0	
Morphine + Tramadol	0	2 (1.5%)	
Tramadol	3 (2%)	3 (2%)	
NSAIDS			
Diclofenac	85 (69%)	47 (34%)	
Ibuprofen	29 (23%)	85 (62%)	
Ibuprofen + Diclofenac	10 (8%)	3 (2%)	
Paracetamol			
Yes	85 (69%)	115 (84%)	
No	39 (31%)	22 (16%)	
Others			
Ketamine	1(1%)	2 (1.5%)	
Lidocaine	1(1%)	0	

Table 2 shows multiple modalities used for pain management. Cold pack was commonly used as a non-pharmacological option to pain management among patients, with use increasing between phase I and III from 5% to 18% (p<0.001) in this cohort. Morphine was the most commonly used opioid both in pre-intervention and post intervention. In addition, diclofenac was among the most used NSAIDS in group one than in group two.

Table 3: Compliance with pain assessment standards and use of pain management protocol

	Pre-intervention N=25	Post-intervention N=23	P value
VAS			p<0.001
Always	10 (40%)	8 (35%)	
Sometimes	5 (20%)	8 (35%)	
Never	10 (40%)	7 (30%)	
FLACC			0.055
Always	2 (8%)	9 (39%)	
Sometimes	12 (48%)	9 (39%)	
Never	11 (44%	5 (22%)	
Numerical scale			0.036
Always	9 (36%)	17 (74%)	
Sometimes	13 (52%)	5 (22%)	
Never	3 (12%)	1 (4%)	
Face scale			0.013
Always	12 (48%)	20 (87%)	
Sometimes	9 (36%)	3 (13%)	
Never	4(16%)	0	
Use of available pain management protocols			p<0.001
Yes	18 (72%)	18 (78%)	
No	7 (28%)	5 (22%)	

Table 3 shows compliance to pain assessment standards and the use of pain management

protocols. The most commonly used pain assessment tool was Face scale that was always used by 48% of the staff (Doctors and Nurses) during the pre intervention stage compared with 87% of the staff in the post intervention. The second most commonly used pain assessment tool was VAS; about 40% of the health care professionals used VAS in pre-intervention period compared with 35% of them in post-intervention.

Table 4. Perceived barriers to pain management at emergency

		Pre-intervention	Post-Intervention	P value
		N=25	N=23	
Use of available pain management protocols and guidelines				0.071
	Yes	11 (44%)	11 (48%)	
	No	14 (56%)	12 (52%)	
Staff related barriers				p<0.010
1. Limited staff		1 (4%)	4 (17.3%)	
2.Inadequate experience and time constraints		4 (16%)	1 (4.3%)	
3.Inadequate experience with pain control		4 (16%)	10 (43.1%)	
4.Inadequate pain assessment:		1 (4%)	2 (9%)	
5.Reluctant to use opioids:		3(12%)	4(17.3%)	
6.Time constraints, poor communication skills with patients	2 (48%)	2(9%)		
Documentation				p<0.001
	Never	1 (4%)	1 (4.3%)	
	Sometimes	17 (68%)	12 (52.2%)	
	Always	7 (28%)	10 (43.5%)	
Patients related barriers				p<0.002
Reluctant to report pain		14(56%)	14 (60%)	
Reluctant to take analgesics and poor communication with medical staff		11(44%)	9 (40%)	

Table 4 shows most commonly barriers to adequate pain   management   at the emergency

department. The most common issue is scarcity of pain management protocols and guidelines. However, some staff also had issues like inadequate experience on pain control and time constraints 16% while in the pre compared to 4.3% in the post intervention and they needed more training. Poor communication skills of staff at emergency was a barrier to adequate pain management at ED. Again, some participants were reluctant to report pain and sometimes to adhere to analgesics.

Table 5. Presentation of patients 'satisfaction level in two groups

	Pre-intervention N=124 Frequency (n) (%)	Post intervention N=137 Frequency (n) (%)	P value
Level of satisfaction			p<0.001
Very Satisfied	43 (24%)	81 (60%)	
Satisfied	28 (18%)	27 (20%)	
Fair	22 (23%)	26 (19%)	
Mild	30 (35%)	2 (1%)	

Table 5 Demonstrates patients' satisfaction level during the course of pain treatment. There was a limited number of those who were very satisfied in the pre-intervention period43(24%)

compared to 81 (60%) of the post-intervention. Therefore, the intervention has improved the quality of care delivered to our patients.

CHAPTER V. DISCUSSION

This pre-intervention and post-intervention study sought to evaluate barriers to the assessment and control of pain among traumatic patients at the ED departments included in the 2 main public referral hospitals in Rwanda (CHUK and CHUB) before and after introduction of protocols and guidelines. The main findings are that the intervention was associated with changes in behavior, but that barriers to optimal pain assessment and management remain.

The main barriers that have been identified as precluding ED medical personnel from proper pain assessment and control include gender bias, age bias, poor knowledge and lack of accurate training for pain control in its early stage, opioid phobia at the ED settings, and the ED routine practices (3).

These barriers likely explain why in index study, where the majority of patients were young males with a median age of 35 [25-48] years, our intervention resulted in only modest changes in reported pain. These findings are similar to those obtained in Tanzania by Dilunga et al, who found young active males to be the most common trauma patients visiting the ED, and recorded mostly mild pain in both those who received assessment as well as those independently assessed by the research assistant using Numeric Rating Scale (21). The findings might well have been different if a population of patients with more severe pain levels were included in the study, but the required sample size precluded such an approach.

Adherence to pain guidelines is still limited for many, including both health professionals and patients (23). This index study showed a slight improvement in adherence to protocols after intervention, for example in the use of assessment and multimodal pain management guidelines (from 72% to 78%). Use of assessment tools approximately doubled: Face Scale from 48% to 87% and the Numerical Rating Scale from 36% to 74%. This indicates both that the intervention had an effect, and that behavior change in providers is feasible. That this substantial increase in

assessment did not result in improved pain scores most likely results from the fact that most

patients had little to no pain. In fact, the post-intervention decrease in patients without pain (from 58% to 24%) may be a result of more attention being drawn to even mild pain, through more frequent assessment.

Pain interventions also increased. The most commonly used non-pharmacological approach, cold packs, increased after intervention from 5% to 18%, and verbal therapy ("talking to medical staff") increased from 1.6% to 15%. Among pharmacological treatments, morphine was used most commonly, and post-intervention its use increased modestly from 41% to 54%. An increase in use of paracetamol (69% to 84%) and ibuprofen (23% to 62%), whereas the use of diclofenac decreased (69% to 34%) was observed in this present study. There is no clear explanation for this latter finding.

Although providers were more likely to administer pain medication, their choices, even after intervention, do not align with major guidelines, either the recommendations of the American school of Surgeons' quality improvement programs for better practice in early stage of pain control in traumatic patients (24), or the European Society for Emergency Medicine (20). Both advocate for use of oral analgesics for mild pain where possible and reserving opiates for patients in severe pain with stable hemodynamics. It should be noted, however, that both of these guidelines are based in large part on the WHO ladder of analgesic usage, which was not designed for acute pain situations, but instead for managing cancer pain. Nonetheless, current data show little or no benefit of opioids over non-steroidal analgesics for treatment of pain in trauma patients.

It is important that the focus on adherence to guidelines for pain assessment and management continues, as further improvement after education has been found effective among health professionals and patients (25).

Among patient-related barriers, it was found that, despite the intervention, less than half of patients communicate with staff and are willing to take their analgesics (44% pre-intervention, 40% post-intervention). Almost half are still reluctant to report pain (56% vs 60%). In other words, there was no clinically relevant improvement with the intervention. These may be cultural

issues that are important to address. A previous study in Rwanda identified a culture of silence related to the patient's level of education, contextual cultures and the availability of time for discussion as major barriers to pain management (27).

Somewhat similarly, among staff-related barriers, this index study showed persistence and even worsening of 3 major factors despite the interventions: a sense of inadequate experience (16% vs 60.4%), time constraints, and poor communication skills with patients (16% vs 43%). Probably as a result of this, inadequate pain assessment and reluctance to use opioids persisted without clinically relevant change after intervention (12% vs 17%).

In the same vein, our study found that more than 50% of the staff are still not using available pain management protocols and guidelines (44% vs 48%), and also documentation is still considered optional by close to half of the staff (48%). Some of these findings are comparable to results reported previously from Tanzania (21) and Rwanda (27).

These barriers have been highlighted by Sergey Motov and Khan in a review of the literature where he identified 5 causes of under-treatment of pain: (a) failure to recognize pain, (b) poor pain assessment at early stage, (c) lack of availability of pain management based on present guidelines in the ED, (d) poor assessment and documentation on adequate pain treatment, and (e) inability to meet patient's satisfaction regarding pain management (3).

Patients' expectations with pain control is fundamental and provides a crucial quality assurance sign of high-quality care (28). This index study showed that intervention doubled the number of satisfied patients (42% to 80%). This is comparable to best practices for multimodal pain management as described by Jenny Barker who found that the multimodal analgesia approach met the target of improving the patient experience through better pain control (29). Nevertheless, it should be noted that pain severity ratings assessed near the time satisfaction was measured are more influential than earlier ratings (30).

CHAPTER VI. CONCLUSION

In both CHUK and CHUB ED, the adherence of patients and staff to pain management guidelines and protocol improved after education. This intervention improved the pain assessment using the VAS tool and the administration of a multimodal approach to improve patient satisfaction. However, significant barriers to further improvement were identified and will need to be addressed for providing sustained improvement of pain assessment, re assessment and pain control in traumatic patients.

REFERENCES

1. Wright K, Adeosun O. Barriers to effective pain management in sickle cell disease. Br J Nurs [Internet]. 2009; 18(3):158–160. Available from http://www.magonlinelibrary.com/doi/10.12968/bjon.2009.18.3.39043

2. Sinatra R. Causes and consequences of inadequate management of acute pain. Pain Med 2010; 11(12): 1859-1871.

3. Motov SM, Khan ANGA. Problems and barriers of pain management in the emergency department: Are we ever going to get better? J Pain Res.2009; 2:5–11.

4. Hadorn F, Comte P, Foucault E, Morin D, Hugli O. Task-shifting Using a Pain Management Protocol in an Emergency Care Service: Nurses' Perception through the Eye of the Rogers's Diffusion of Innovation Theory. Pain Manag Nurs [Internet]. 2016;17(1):80–87. Available from:http://dx.doi.org/10.1016/j.pmn.2015.08.002

5. Bergman CL. Emergency Nurses' Perceived Barriers to Demonstrating Caring When Managing Adult Patients' Pain. J Emerg Nurs [Internet]. 2012;38(3):218–225. Available from:http://dx.doi.org/10.1016/j.jen.2010.09.017

6. Berben SAA, Meijs THJM, Van Grunsven PM, Schoonhoven L, Van Achterberg T. Facilitators and barriers in pain management for trauma patients in the chain of emergency care. Injury [Internet]. 2012; 43(9):1397–1402. Available from: http://dx.doi.org/10.1016/j.injury.2011.01.029

7. Fry M, Bennetts S, Huckson S. An Australian Audit of ED Pain Management Patterns. J Emerg Nurs [Internet]. 2011; 37(3):269–274. Available from:http://dx.doi.org/10.1016/j.jen.2010.03.007

8. Dale J, Bjørnsen LP. Assessment of pain in a Norwegian Emergency Department. Scand J Trauma Resusc Emerg Med [Internet]. 2015;23(1):1–5. Available from: http://dx.doi.org/10.1186/s13049-015-0166-3

9. Graham J. Adult patients' perceptions of pain management at triage: A small exploratory study. Accid Emerg Nurs.2002; 10(2):78–86.

10. Bennetts S, Campbell-Brophy E, Huckson S, Doherty S. Pain management in Australian emergency departments: EMA - Emerg Med Australas.2012;24(2):136–143.

11. Kuusniemi KS, Olkkola KT. Opioids in emergency medicine - Are we treating pain adequately? Scand J Pain [Internet]. 2011; 2(4):185–186. Available from: http://dx.doi.org/10.1016/j.sjpain.2011.08.004

12. Minick P, Clark PC, Dalton JA, Horne E, Greene D, Brown M. Long-Bone Fracture Pain Management in the Emergency Department. J Emerg Nurs [Internet]. 2012; 38(3):211–217. Available from:http://dx.doi.org/10.1016/j.jen.2010.11.001

13. Pak SC, Micalos PS, Maria SJ, Lord B. Nonpharmacological interventions for pain management in paramedicine and the emergency setting: A review of the literature. Evid Based Complement Alternat Med 2015; 2015:873039. doi: 10.1155/2015/873039
.J.G.J. P, M.J. I, M.I. G, S.A. B, F.L. van E, A.B. van V. Pain Management in the Emergency Chain: The Use and Effectiveness of Pain Management in Patients with Acute Musculoskeletal Pain. Pain Med. 2015;16(5):970–84.

14. Ridderikhof ML, Schyns FJ, Schep NW, Lirk P, Hollmann MW, Goslings JC. Emergency Department Pain Management in Adult Patients with Traumatic Injuries Before and After Implementation of a Nurse-Initiated Pain Treatment Protocol Utilizing Fentanyl for Severe Pain. J Emerg Med [Internet]. 2017;52(4):417–425.

15. Parnass AJ, Greenbaum NR, Glick MA, Halpern P. Pain management framework in the emergency department: Patterns in 40 emergency departments worldwide. Eur J Emerg Med.2016; 23(4):311–4.

16. Patrick PA, Rosenthal BM, Iezzi CA, Brand DA. Timely pain management in the emergency department. J Emerg Med [Internet]. 2015; 48(3):267–273.

17. Puntillo K, Neighbor M, O'Neil N, Nixon R. Accuracy of emergency nurses in assessment of patient's pain. Pain Manag Nurs.2003; 4(4):171–175.

18. Rampanjato RM, Florence M, Patrick NC, Finucane BT. Factors influencing pain management by nurses in emergency departments in Central Africa. Emerg Med J. 2007;24(7):475–476.

19. Idrissi SH. Guidelines for the Management of Acute Pain in emergency situations. Management.2020;(March):79.

20. Dilunga GD, Sawe HR, Kulola IB, Mfinanga JA, Lucumay NJ, Mulesi EM, et al. Pain assessment and management of trauma patients in an emergency department of a tertiary hospital in Tanzania. Saf Heal.2018;4(1):8–13.

21. Ahmadi A, Z HZ, Euasobhon P, Ketumarn P, Karbasfrushan A, Mohammadi R. Pain management in trauma: A review study. J Inj Violence Res. 2016 Jul; 8(2):89-98.

22. Kerner Y, Plakht Y, Shiyovich A, Schlaeffer P. Adherence to guidelines of pain assessment and intervention in internal medicine wards. Pain Manag Nurs [Internet]. 2013;14(4):302–309.

23. Trauma ACS, Programs Q. Acs Trauma Quality Programs Guidelines for Acute Pain Management in.2020.

24. Moore BA, Anderson D, Dorflinger L, Zlateva I, Lee A, Gilliam W, et al. Stepped care model for pain management and quality of pain care in long-term opioid therapy. J Rehabil Res Dev.2016;53(1):137–146.

25. Sun V, Wendel CS, Demark-Wahnefried W, Grant M, McMullen CK, Bulkley JE, et al. Diet and Behavior Modifications by Long-term Rectal Cancer Survivors to Manage Bowel Dysfunction-Associated Symptoms*. Nutr Cancer [Internet]. 2019;71(1):89–99.

26. Nyirigira G, Wilson RA, VanDenKerkhof EG, Goldstein DH, Twagirumugabe T, Mahaffey R, et al. Barriers and facilitators to postoperative pain management in Rwanda.

27. Mubita WM, Richardson C, Briggs M. Patient satisfaction with pain relief following major abdominal surgery is influenced by good communication, pain relief and empathic caring: a qualitative interview study. Br J Pain.2020;14(1):14–22.

28. Ashton MW. Tips on Raising Reliable Local Perforator Flaps. Plast Reconstr Surg Glob Open. 2021 Jul; 9(7): e3673. doi: 10.1097/GOX.0000000000003673

29. DemarayMK,RuffaloSL,CarlsonJ,BusseRT,OlsonAE,McManusSM,etal.Social

30 Skills Assessment: A Comparative Evaluation of Six Published Rating Scales. School Psych Rev. 1995; 24(4):648–671.

APPENDICES

Appendix 1: SURVEY QUESTIONNAIRE

All questionnaires are answered anonymously.

1. **Pain Out Comes Questionnaire (For patients) :**

P1. On this scale, please indicate the worst pain you had since your arrival in Emergency department:

0   1   2   3   4   5   6   7   8   9   10

| | | | | | | | | | |

P2. On this scale, please indicate the least pain you had since your arrival in Emergency department:

0   1   2   3   4   5   6   7   8   9   10

| | | | | | | | | | |

P3. How often were you in severe pain since your arrival in Emergency department? Please circle your best estimate of the percentage of time you experienced severepain:

0 10 20 30 40 50 60 70 80 90100%

| | | | | | | | | | |

P4. Circle ONE number below that best describes how much, since your traumatic status, pain interfered with or prevented you from...

a.   Doing activities in bed such as turning, sitting up, changing

position: 0   1   2   3   4   5   6   7   89   10

| | | | | | | | | | |

b. Breathing deeply orcoughing:

0   1   2   3   4   5   6   7   8   9   10

| | | | | | | | | | |

c. Sleeping:

0   1   2   3   4   5   6   7   8   9   10

| | | | | | | | | | |

d. Have you been out of bed since your arrival in Emergency department?

- Yes
- No

If yes, how much did pain interfere or prevent you from doing activities out of bed such as
Walking, sitting in a chair, standing at the sink:
0   1   2   3   4   5   6   7   8   9   10

| | | | | | | | | | |

P5. Pain can affect our mood and emotions.
On this scale, please circle ONE number that best shows how much, since your arrival in
Emergency department: pain caused you to feel...

a.   Anxious:

0   1   2   3   4   5   6   7   8   9   10

| | | | | | | | | | |

b. Helpless:

0   1   2   3   4   5   6   7   8   9   10

| | | | | | | | | | |

P6. Have you had any of the following side effects since your arrival in Emergency department?

Please circle "0" if no; if yes, circle the one number that best shows the severity of each:

      a.   Nausea:

0 1 2 3 4 5 6 7 8 9 10

| | | | | | | | | | |

      c. Drowsiness:

0 1 2 3 4 5 6 7 8 9 10

| | | | | | | | | | |

      d. Itching:

0 1 2 3 4 5 6 7 8 9 10

| | | | | | | | | | |

      e. Dizziness

0 1 2 3 4 5 6 7 8 9 10

| | | | | | | | | | |

P7. Since your arrival in Emergency department, how much pain reliefs have you received?

Please circle the one percentage that best shows how much relief you have received from all of your pain treatments combined (medicine and non-medicine treatments):

0   10 20 30 40 50 60 70 80 90100%

| | | | | | | | | | |

P8. Would you have liked MORE pain treatment than you received?

- Yes
- No

P9. Did you receive any information about your pain treatment options?

- Yes
- No

P10. Were you allowed to participate in decisions about your pain treatment as much as you wantedto?

0   1   2   3   4   5   6   7   8   9   10

| | | | | | | | | | |

P11. Circle ONE number that best shows how satisfied you are with the results of your pain treatment since your arrival in Emergency department:

0   1   2   3   4   5   6   7   8   9   10

| | | | | | | | | | |

P12. Did you use or receive any non-medicine methods to relieve your pain?

- Yes
- No

If yes, check all that apply:

Cold pack, meditation, deep breathing, heat, acupuncture, prayer, talking to medical staff,

Walking, massage, talking to friends or relatives, relaxation, imagery or visualization, TENS

(Transcutaneous Electrical Nerve Stimulation), distraction (like watching TV, listening to music, reading), other (please describe)

P13. Did you have a persistent painful condition for 3 months or more before coming into Emergency department?

- Yes
- No

a. If yes, how severe was the pain most of the time? Please circle the number that indicatesthis.

0   1   2   3   4   5   6   7   8   9   10

| | | | | | | | | | |

b. If yes, where was this persistent pain located? (Circleone)

Site of traumatic injury, elsewhere, both (site of traumatic injury and elsewhere)

P14. Analgesics prescribed to the patient:

- Opioids:
  a. Morphine,
  b. Fentanyl
  c. Others…
- NSAIDs:
  a. Ibuprofen
  b. Diclofenac
  c. Others…
- Paracetamol
- Others…

P15. Current vitals at interview:

- BP:
- HR:
- RR:
- SaO_2:
- T^0:

1. **Quality pain management care (ForStaff)**

Characteristics of physicians and their practices related to pain management in emergency departments (ED) in referral hospitals/Rwanda	Perceived barriers to pain management among emergency department physicians in referral hospitals/Rwanda
Gender: - Male - Female	**Barriers:** **Related to medical staff:** Inadequate pain assessment

Age: years,

ED experience in years: --------

Experience in Healthcare   years

Specialty:

    General practitioner

    Emergency and intensive care medicine

    Others:

        Nurse

        post- graduate student

        Please specify year of training**:** _

Evaluation of pain is useful:

    No

    Yes:

Pain management education:

    No

    Yes

    If yes, Curriculum

Continuous medical education

Hospital Protocols & Guidelines

Practices:

    Pain assessment

        No

        Yes

Use of simple interrogatory assessment

Use of algometric scales

Documentation of pain assessment

    Never

Inadequate experience on pain control Insufficient knowledge of paincontrol

Time constraints (busy)

Reluctance to use opioid

Insufficient communication with patient

Others specify…

Related to patient:

    Reluctance to report pain

    Reluctance to take analgesic

    Insufficient communication with medical staff

    Others specify………

Related to health care system:

    Strict regulation of opioids

    Inadequate staffing

    Limited stock of different types of analgesics or stock out of analgesics

    Pain management is not important

Patients 'file documentation:

    Working diagnosis:

        Burn injury

        Fractures

        Gun shots

        Penetrating injury

        Others...
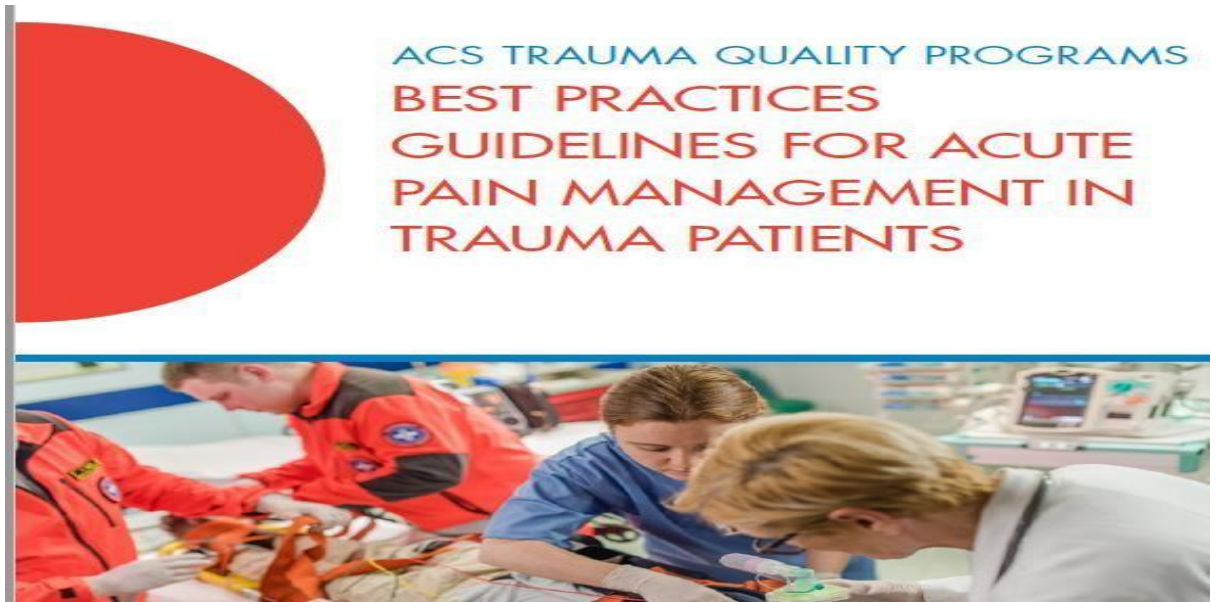
Do you have Pain guideline/protocol at your

Sometimes	ED or at hospital level?
	•
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• Always **Pain reassessment after treatment:** • Never • Sometimes • Always **Availability of written protocol for pain treatment** • No • Yes	• Yes • No

Appendix 2: TRAUMA PAIN MANAGEMENT BASED ON WHO PAIN LADDER

Table 1: Trauma Pain Management based on WHO Pain Ladder.

	Methods	Results	Action
Pain Assessment			
Acute Pain treatment			
Mild	VAS	$\frac{1-3}{10}$	Pentazocine NSAID's Cold/Hot compresses
Moderate	VAS	$\frac{4-6}{10}$	Cold/Hot compresses Tramadol Pethidine
Severe	VAS	$\frac{7-10}{10}$	Morphine Fentanyl
Re-assessment	Reassess every 5 minutes. Evidence of adverse effects should preclude further drug administration		

Appendix 3: ACS GUIDELINES FOR ACUTE PAIN MANAGEMENT IN TRAUMA PATIENTS.

Trauma ACS, Programs Q. Acs Trauma Quality Programs Guidelines for Acute Pain Management in. 2020.