Efficacy of the Mnemonic Device "MARCH/PAWS" as a Checklist for Pararescuemen During Tactical Field Care and Tactical Evacuation

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ABSTRACT

Background: The application of Tactical Combat Casualty Care (TCCC) represents evidence-based medicine to improve survival in combat. Over the past several years, US Air Force Pararescuemen (PJs) have expanded the mnemonic device "MARCH" to "MARCH/PAWS" for use during tactical field care and tactical evacuation (TACEVAC). The mnemonic stands for massive bleeding, airway, respiration, circulation, head and hypothermia, pain, antibiotics, wounds, and splinting. We undertook this performance improvement project to determine the efficacy of this device as a treatment checklist. **Methods:** The mission reports of a 16-PJ combat rescue deployment to Operation Enduring Freedom (OEF) from January through June 2012 were reviewed. The triage category, mechanism of injury, injury, and treatments were noted. The treatments were then categorized to determine if they were included in MARCH/PAWS. **Results:** The recorded data for missions involving 465 patients show that 45%, 48%, and 7%, were in category A, B, and C, respectively (urgent, priority, routine); 55% were battle injuries (BIs) and 45% were nonbattle injuries (NBIs). All treatments for BI were accounted for in MARCH/PAWS. Only 9 patients' treatments with NBI were not in MARCH/PAWS. **Conclusion:** This simple mnemonic device is a reliable checklist for PJs, corpsmen, and medics to perform TACEVAC during combat operations, as well as care for noncombat trauma patients.

KEYWORDS: *Tactical Combat Casualty Care; survival; Pararescuemen; mnemonic; MARCH/PAWS; tactical field care; tactical evacuation*

Introduction

Throughout OEF and Operation Iraqi Freedom (OIF), USAF PJs were tasked with performing personnel recovery and combat search and rescue for coalition forces. Rescue PJs (usually from Air Combat Command) generally received patients directly from the point of injury on the battlefield or from forward operating bases. In other instances, Special Tactics PJs (generally from Air Force Special Operations Command) supported various units from sister services and frequently provided care under fire in addition to tactical field care and tactical evacuation (TACEVAC). In many instances, minimal care was performed on patients before the PJs received them.[1,2] Overall, patient assessment and treatment were often performed in dynamic and chaotic environments in which time and tactics were considerations that competed with or took precedence over clinical concerns.

The application of TCCC represents evidence-based medicine to improve survival in combat.[3,4] The Committee for TCCC and other organizations popularized the mnemonic device "MARCH" to aid PJs, corpsmen, and medics in providing immediate lifesaving care to combat casualties. However, it did not account for secondary treatments that needed to be addressed during TACEVAC. Over time during OEF, "PAWS" was added based on feedback from operations and development during PJ medical training courses, often as an attempt to ensure covering (hypothermia prevention) patients and administration of early antibiotics to combat trauma patients were not forgotten. Thus, MARCH/PAWS was developed as a checklist-based approach to the assessment and treatment of combat injuries by addressing immediate life threats first and then attending to injuries that could result in delayed morbidity and mortality. Essentially, "MARCH" addresses the primary survey, and "PAWS" roughly addresses the secondary survey (Table 1).

Table 1 *The Acronym MARCH/PAWS Is Recommended to Guide the Priorities in the Care Under Fire (Control of Life-Threatening Hemorrhage Only) and Tactical Field Care Phases*

Massive hemorrhage—*Control life-threatening bleeding* (tourniquet, direct pressure, pressure dressing, pelvic sling, junctional tourniquet)
Airway—*Establish and maintain a patent airway* (chin lift/jaw thrust. recovery position, sit up and lean forward for oral bleeding, NPA, supraglottic device, ET tube, cricothryotomy)
Respiration—*Decompress suspected tension pneumothorax, seal open chest wounds, and support ventilation/oxygenation as required* (chest seal, needle compression, bag-valve-mask, oxygen)
Circulation—*Establish IV/IO access and administer fluids as required to treat shock* (diagnose and treat shock, IV/IO whole blood red blood cells/fresh frozen plasma or Hextend 500 mL as needed, TXA)
Head injury/**H**ypothermia—*Prevent/treat hypotension and hypoxia to prevent worsening of traumatic brain injury and prevent/treat hypothermia* (diagnose increased ICP, prevent hypoxia and hypotension/**H**ypothermia Prevention and Management Kit (HPMK), elevate off ground, remove wet clothing)
Pain—*Administer appropriate analgesia or sedation to manage pain* ([1] Mobic/Tylenol; [2] fentanyl OTFC; [3] ketamine or fentanyl IV/IM)
Antibiotics—*Administer battlefield antibiotics for early prevention of infection* (PO or IV/IO/IM for all open combat wounds)
Wounds—*Assess and dress additional wounds and check prior interventions* (clean and dress)
Splinting—*Splint all fractures or provide support to limb dressings* (SAM, KTD, spine, rigid eye shield)

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MARCH/PAWS is an acronym that stands for massive bleeding, airway, respiration, circulation, head injury/hypothermia, pain, antibiotics, wounds, and splinting.[5] While MARCH/PAWS was developed to address BIs, we realized it was applicable to NBIs and nonbattle illnesses as well. This is important because during the height of OEF, approximately half of the rotary wing evacuations performed by PJs were NBIs and nonbattle illnesses. This project was undertaken to validate MARCH/PAWS as a checklist for medical care provided by PJs.

Methods

This report is the result of a process improvement study, which was approved by the Air Force Research Oversight and Compliance Division.

Patient care reports (PCRs) completed by PJs deployed in Helmand Province, Afghanistan, during the time of 1 January 2012 through 30 June 2012 were reviewed. PCRs were filled out immediately after each mission by the PJs directly involved in the treatment of the patient. Information extracted from the PCR included mechanism of injury, injuries and findings, treatments, and timelines. The treatments were categorized by the letter in MARCH/PAWS and noted if they fell outside of that. This project focused on this latter point to validate the efficacy of MARCH/PAWS as a checklist.

Four hundred sixty-five consecutive PCRs written by 16 different PJs during the noted deployment were reviewed. Information on patient sex, age, evacuation category, mechanism of injury, injuries, and treatments received was collected from each PCR. The treatment each patient received included all treatment recorded from the point of injury (provided by ground forces or PJs) until the PJs turned the patient over to a higher level of medical care. Ground care not given by PJs includes treatment performed prior to the arrival of PJs, such as self-aid and buddy care, or treatment by a ground medic. Each treatment was tallied according to its category in the MARCH/PAWS algorithm to provide a perspective of the relative frequencies of injury types and the relative frequency of treatments performed.

It should also be noted that any category C patient who that received treatment by PJs was included because they were transported with at least one category A or B patient; no mission was executed exclusively for a category C patient. The treatments delivered per MARCH/PAWS are summarized in Table 1; most are essentially consistent with the TCCC guidelines and the USSOCOM Tactical Trauma Protocols (TTPs) (published in *the Journal of Special Operations Medicine/Advanced Tactical Paramedic Protocols* [*ATP-P*] *Handbook*).[5]

Results

During the 6 months observed in this study, the PJs transported a total of 465 patients. Of these 465, 437 underwent treatments. The basic demographics of the patients are shown in Figure 1.

The patients were given standard combat casualty categorizations of A, B, or C by the parties requesting CASEVAC before launch in order to determine urgency. The nature of a patient in each category and time for evacuation are explained in Table 2. Category A patients required definitive surgical treatment within 1 hour from the time of injury and accounted for 45% of patients. Category B patients were stable and required definitive care within 4 hours, accounted for 48% of patients (Figure 2).

Figure 1 *Patient demographics.*

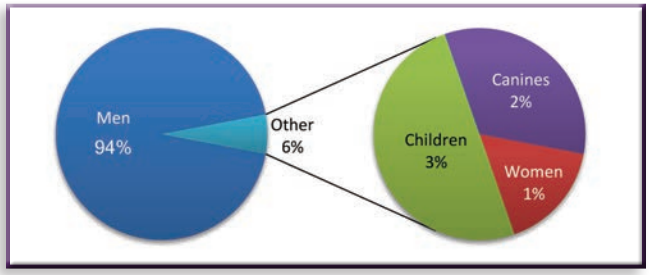


Table 2 *Injury Categories*

A: Life-threatening injuries that generally required a MARCH intervention and included severe traumatic brain injury, severe burns, spinal cord injury; patients are often unstable; evacuation required within the hour
B: Severe injury that is not life threatening and vital signs are stable. This includes injuries such as open fractures, evisceration, eye injuries, etc.; 2- to 4-hour evacuation
C: Minimal injury but requires medical care beyond patrol medicine; stable patient; evacuation acceptable up to 24 hours

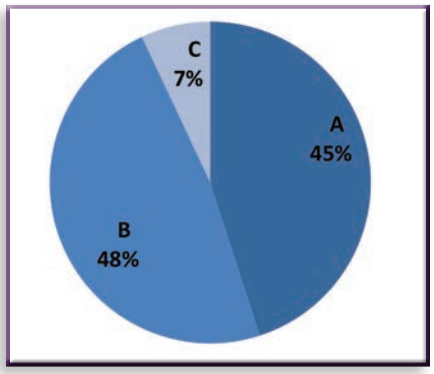


Figure 2
Patient category distribution.

Of the patients from this study, 240 (55%) sustained BIs and 225 (45%) had NBIs and nonbattle illnesses (Figure 3). The most prevalent BIs were gunshot wounds (20.2%) and blast injuries from improvised explosive devices (IEDs) (21.6%). Injury from IEDs was subdivided into mounted (in a vehicle) (8.7%) and dismounted IEDs triggered while outside of a vehicle (12.9%) (Figure 4). The most prevalent NBIs were illness and accidents (motor vehicle accidents and falls). Illnesses included a wide variety of problems ranging from infections to cardiac issues (Figure 5).

Overall, 98% of all treatments were covered by MARCH/PAWS (Figure 6). And 100% of BI treatments and 95% of NBI treatments were encompassed by MARCH/PAWS (Figure 6). The most common interventions were P (pain management) and C (vascular access and fluid administration) in 59% and 34% of patients, respectively . These were followed by W, H, S, and the remaining letters in the mnemonic (Figure 7).

It is important to note that some treatments in this theater of operation were not performed due to short flight times. For instance, there was more wound care performed than antibiotics given. When discussed with the Operators, this was due to either

Figure 3 *Frequency of battle injuries and nonbattle injuries (NBIs) in 465 patients. Battle injuries were sustained during combat and did not include accidents using combat equipment or vehicles while not participating in combat.*

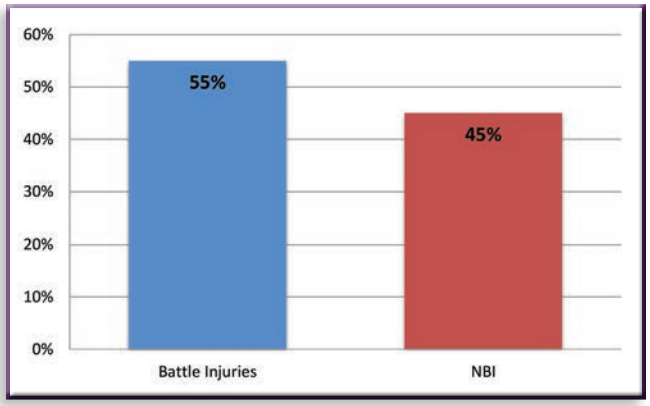
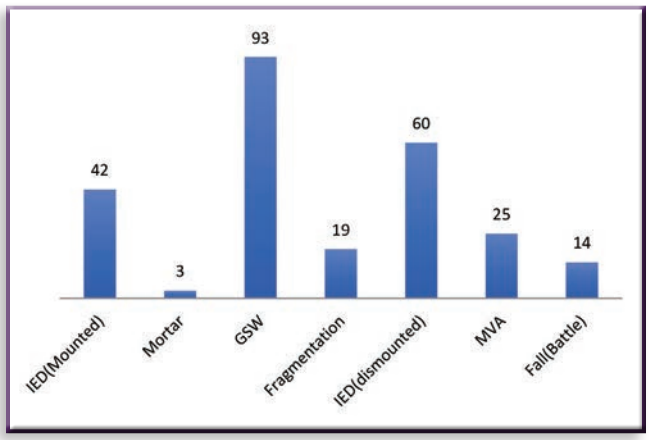


Figure 4 *Mechanism of injury for battle injuries. GSW, gunshot wound; MVA, motor vehicle accident. Values given as n values.*



the lack of flight time to complete treatment while performing other treatments, forgetting to do it, and, in some instances, the lack of a combat pill pack with certain ground units.

The diagnoses for 11 treatments not covered in MARCH/PAWS but in specialized protocols are shown in Figure 8.

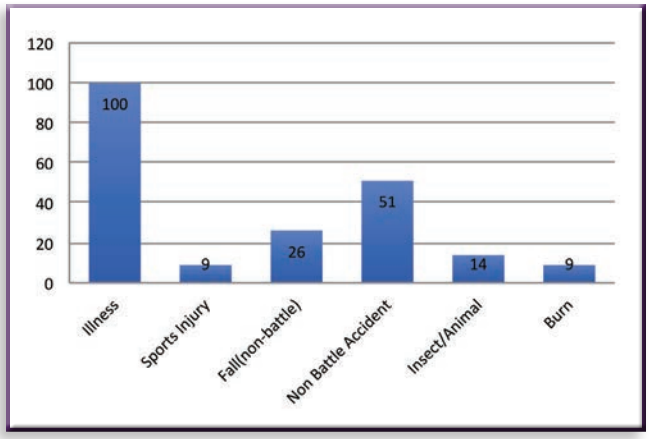
Discussion

The mnemonic device MARCH/PAWS was an effective checklist for all of the combat trauma patients and almost all of the patients with NBIs/nonbattle illnesses who were rescued by the PJs.

MARCH/PAWS was originally promoted to keep the PJs from forgetting things like blankets for trauma patients and antibiotics for patients with wounds, based on direct feedback to the PJ medical director from the Air Force trauma consultant. Around this time, the benefit of checklists in medicine were becoming popularized to reduce human error.[6–12] This performance improvement project validates the value of this checklist for both combat trauma and NBI/nonbattle illness.

To reinforce the checklist, we created a patient care card with two sides (this does not replace the DOD 1380 form). It follows the AT_ MIST format so that the front includes the age, time, MOI, injuries, signs and symptoms. The back included the treatments in MARCH/PAWS format. This allows the PJ to document the care and at the same time be reminded if he forgot to do something.

Figure 5 *Mechanism of injury for nonbattle injuries.*



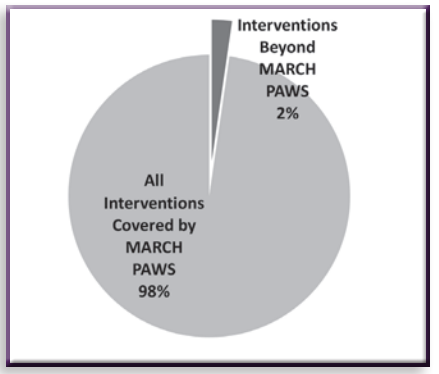
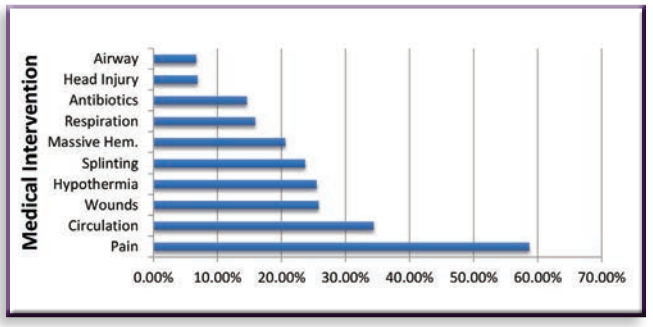


Figure 6 *Adequacy of MARCH/PAWS to cover all treatments.*

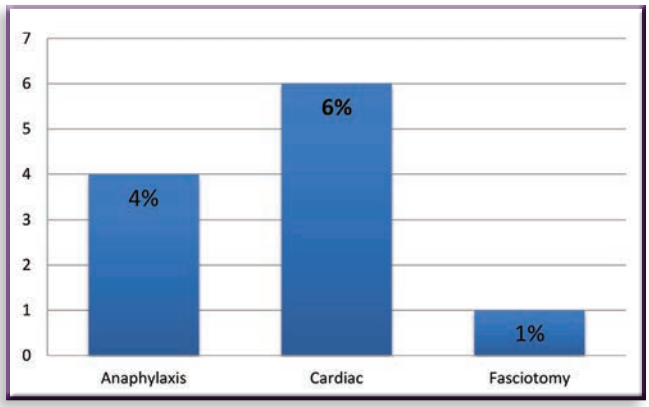
Figure 7 *Treatment rendered based on the MARCH/PAWS mnemonic, showing Guardian Angel interventions performed in the Helmand River Valley From January to June 2012.*



Massive bleeding (M) treatments performed 21% of the time included tourniquets and direct pressure and pressure dressings with or without hemostatic gauze. The value of tourniquets became evidence based as OEF and OIF progressed. It is hard for today's young PJs, corpsmen, and medics to conceive that not only were there no commercial tourniquets available for several years but not all combatants were trained to use them.[13,14] Hemostatic gauze was validated in animal studies and later by the Israel Defense Forces.[15–18]

Pelvic binders were variably placed during M or later in the algorithm. PJs began using pelvic binders during the time frame of this study due to the co-location with the British Medical Emergency Responses Teams (MERTs), who aggressively used this for obvious pelvic fractures as well as any bilateral lower extremity amputee due to the high associated pelvic fracture rates.[19–22]

Figure 8 *Beyond MARCH/PAWS: treatments rendered not covered in MARCH/PAWS.*



Airway management (A) was performed 7% of the time. This included an NPA for all unresponsive patients, endotracheal intubation, placement of a supraglottic airway device (primarily King LT during this time), and cricothyroidotomy.[23] One key airway management change we made in rotary wing medical operations during OEF was the introduction of video laryngoscopy to facilitate intubating from the side of the patient and increase first-pass success. [24–26]

Respiratory management (R) performed 16% of the time included needle decompression, chest tube, chest seal, assisted ventilation with bag mask or mechanical ventilator, and supplemental oxygen. The benefit of needle decompression is evident by the reduction in tension pneumothorax as an important cause of potentially preventable death.[4,27] We have subsequently standardized finger thoracostomy as an option to a chest tube when time and tactics do not permit chest tube placement but the patient requires decompression after needle decompression fails. Guidelines for the management of open chest wounds with chest seals have evolved to be vented based largely on animal studies and experiments by Kherabladi and colleagues to prevent subsequent development of a life-threatening tension pneumothorax.[28,29]

Circulation interventions (C), performed 35% of the time, was focused on establishing intravenous or intraosseous access and delivery of blood (when available) for hemorrhagic shock or crystalloids for hypotension from medical problems.

Severe TBI (7%) and hypothermia (26%) make up the Hs. Prevention of hypoxemia and hypotension are the mainstays of the care for severe TBI associated with increased intracranial pressure. More awareness of giving hypertonic saline is a more recent effort.[30] Hypothermia prevention to reduce coagulopathy and the occurrence of the lethal triad in trauma patients have become more aggressive over time.[31]

As noted in the Results, pain management (P) was the most frequent intervention. During the time of this study, PJs began using ketamine more often—again, because of the influence of the MERT. The enhanced risk:benefit ratio compared with the use of opiates was a significant advance for managing traumatic pain in OEF.[32,33] Over time, we also became more aggressive about ensuring that we ask Soldiers and Marines if they took their pill pack. It was routine for PJs to carry two fentanyl lozenges in one shoulder pocket and a preloaded ketamine syringe in another. In many instances where US and partner forces were entrapped with major injuries, being able to administer intramuscular ketamine and take the edge off the agitation made the extrication problem easier. We now carry intranasal atomizers as an option, though one must be careful if it is in the setting of a blast injury to ensure that dirt has not clogged the nasal passages.

Antibiotic (A) use (15%) in trauma improved over time, with a goal of being to administer antibiotics early to reduce the risks of wound infection and sepsis. This is supported by data from studies in animals and some data from OIF.[34] Antibiotics were also used for NBI with infections.

Wound care (W) (26%) cannot be overemphasized. While antibiotics are effective and useful, the general tenets of removing gross debris, irrigating, and covering the wound to prevent further contamination are gold standards for prehospital trauma care. This is done to buy time to get to definitive wound care by surgeons.

Splinting (S) is the catch-all to include the place to document cervical-spine or spinal motion restriction when indicated, placement of a rigid eye shield for penetrating eye trauma, and other splinting and immobilization for fractures and significant soft tissue injuries.[35,36] Although pelvic binders play a role in hemorrhage control, they are included here as an orthopedic aid as well.

MARCH/PAWS did not come into widespread use until after the deployment discussed here earlier. Therefore, this project was performed to retrospectively validate its value as a convenient and thorough checklist.

The implementation of MARCH/PAWS through Pararascue has occurred over several years and essentially is a cultural change. Presenting it in the new PJ Medical Operations Handbook, discussing it at courses and the Medical Operations Advisory Board, and the use of social media were all integral in changing practices among practicing PJs. We also included this in the 2014 rewrite of our schoolhouse educational program in Kirtland so new PJs were learning it at the beginning of their career.

MARCH/PAWS fits into the Pararescue culture because of the importance of TACEVAC in Pararescue Operations. The use of checklists in the Air Force is also a cultural norm. The universal adoption of MARCH/PAWS by PJs allows PJs coming from a different team to augment another team in a seamless manner. This may have the same carryover to other organizations to improve standardization of care and increase the ease of an Operator supporting another team and providing care the same way by all Operators.

Various tools that can assist learning for the PJs, corpsmen, and medics, and make it more likely not to miss anything on patients are likely to improve patient care for our Warfighters. These tools for learning and treating should be maximized, optimized, and validated. It would be reasonable to validate this prospectively in a future conflict with significant mission numbers.

Conclusion

MARCH/PAWS is a mnemonic device that can serve as a valid trauma and medical care checklist for PJs, corpsmen, and

medics for both combat trauma and emergency medical responses on deployment.

Disclosure

The authors have nothing to disclose.

Author Contributions

All authors approved of the final version of the manuscript.

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