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Comfort care in trauma patients without severe head injury: In-hospital complications as a trigger for goals of care discussions

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ABSTRACT

Introduction: Many injured patients or their families make the difficult decision to withdraw life-sustaining therapies (WLST) following severe injury. While this population has been studied in the setting of severe traumatic brain injury (TBI), little is known about patients who undergo WLST without TBI. We sought to describe patients who may benefit from early involvement of end-of-life resources.
Methods: Trauma Quality Improvement Program (2013–2014) patients who underwent WLST were identified. WLST patients were compared to those who died with full supportive care (FSC). Patients were excluded for death within 24 h of admission, or head AIS $\geq$ 3. Intergroup comparisons were by student's t tests or Wilcoxon rank sum tests; significance for $p < 0.05$.
Results: We identified 3471 total injured patients without major TBI who died > 24 h after admission. Of these death after WLST occurred in 2301 (66% of total). This group had a mean age of 66.8 years; 35.7% were women, and 95.4% sustained blunt injury. WLST patients had a higher ISS (21.6 vs. 12.5, $p = 0.001$), more in-hospital complications (71.4% vs. 41.6%, $p = < 0.0001$), and a longer ICU length of stay (8.9 days vs. 7.5 days, $p = <0.0001$) compared to patients who died with FSC.
Conclusion: WLST occurs in two-thirds of injured patients without severe TBI who die in the hospital. In-hospital complications are more frequent in this patient group than those who die with FSC. Early palliative care consultation may improve patient and family satisfaction after acute injury when the timeframe to leverage such services is significantly condensed.

Introduction

Up to 90% of all hospitalized patients die following the limitation or withdrawal of life sustaining therapies (WLST) [1–3]. While the provision of end-of-life (EOL) care is one key role of a critical care physician, it remains one of the least studied. EOL decision-making following severe injury is often complicated by the sudden onset of illness, the multisystem impact of sustained injuries, by difficulties locating or establishing surrogate decision makers, and the usually excellent pre-injury health of younger patients. Given these interwoven aspects of care, it is essential to clearly delineate patients for whom transitioning from FSC to comfort care by WLST is most appropriate in order to accurately and timely counsel patients, families, and surrogates.

The withdrawal of life supporting treatment has been previously studied in injured patients [4,5]. These studies included a preponderance of patients (79%) who sustained traumatic brain injury (TBI) and as such do not extrapolate well to those without TBI – a group that has been far less well investigated. Therefore, the goal of this study was to describe the demographics and injury patterns of injured patients without significant TBI who underwent WLST to define characteristics that would inform caregivers, patients, families, and surrogates about potential triggers and timing for EOL decision-making and consultant engagement.

Materials and methods

We performed a retrospective cohort study of injured patients age 16 and older in the 2013–2014 Trauma Quality Improvement Program (TQIP) database who underwent WLST. TQIP defines

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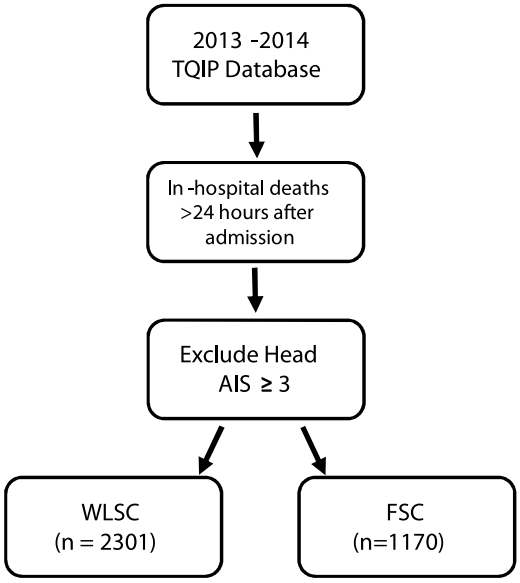

Fig. 1. Experimental Design.
The 2013–2014 TQIP database was queried for all in-hospital deaths which occurred greater than 24 h after admission. Patients with a Head AIS of ≥ 3 were excluded. The remaining patients were divided into two cohorts, those who underwent WLST prior to death and those that died with full supportive cares. TQIP (Trauma Quality Improvement Project), WSTL (Withdrawal of Life Sustaining Therapies), AIS (Abbreviated Injury Scale), FSC (Full Supportive Care).

WLST as occurring when "treatment was withdrawn based on a decision to either remove or withhold further life supporting intervention". This variable importantly includes patients who limit escalating life sustaining care, but continued established care. Exclusion criteria included: 1) severe TBI (head Abbreviated Injury Score, AIS ≥ 3), and 2) death within 24 h of admission, as such patients were unlikely to have had an opportunity to benefit from palliative care or EOL discussions. Hospitalized patients who died while undergoing WLST were compared with those who died while receiving full life- supportive care (FSC) (Fig. 1).

Data source and variables

TQIP was deployed in 2008 by the American College of Surgeons Committee on Trauma (ACS–COT) as a voluntary quality improvement database and tool, providing risk-adjusted data to support trauma care quality improvement activities [6]. The 2013 and 2014 data sets contain de-identified patient-level data from participating designated and ACS-verified Level I and II centers. As of 2014, the TQIP database contained patient information from more than 200 level I or II facilities. Extracted variables included age, sex, abbreviated injury scale (AIS), injury severity score (ISS), mechanism of injury, race, total ventilator days, length of hospital and ICU stays, pre-existing comorbidities and in-hospital complications. Data dictionary definitions conformed to those in use at the time of data entry including sepsis, severe sepsis and septic shock.

Table 1
Patient and Injury Demographics. Demographics comparing patients who underwent WLST >24 h following injury with a head AIS < 3 to patients that died with full supportive measures > 24 h following injury with head AIS < 3. Data presented as means except where indicated. ICU (Intensive Care Unit), WSTL (Withdrawal of Life Sustaining Therapies), AIS (Abbreviated Injury Scale), FSC (Full Supportive Care).

	WLST (n = 2301)	FSC (n = 1170)	p-Value
Age (SD)	66.8 (17.6)	75.0 (14.7)	<0.001
Female Gender (n)	35.7% (821)	54.8% (641)	<0.001
ISS (SD)	21.6 (15.3)	12.5 (8.1)	0.001
AIS Head (SD)	2.1 (0.7)	2.2 (0.6)	0.16
AIS Abdomen (SD)	2.3 (0.9)	2.0 (1.0)	0.001
AIS Chest (SD)	2.8 (0.7)	2.7 (0.7)	0.13
Blunt Mechanism (n)	95.4% (2195)	98.5% (1152)	0.001
White Race (n)	83.3% (1917)	89.0% (1041)	<0.001
African American Race (n)	7.4% (171)	3.2% (38)	<0.001
Ventilator Days (SD)	8.2 (8.8)	9.2 (9.9)	<0.001
ICU Days (SD)	8.9 (9.3)	7.5 (8.5)	<0.001
Hospital Length of Stay (SD)	10.6 (10.7)	9.6 (10.5)	<0.001
Days to WLST (SD)	9.7 (10.2)	–	–

Table 2
Patient Comorbidities. Comorbidities in patients who underwent WLST >24 h following injury with a head AIS < 3 compared with patients that died with full supportive measures > 24 h following injury with head AIS < 3. Data presented as means except where indicated. WSTL (Withdrawal of Life Sustaining Therapies), AIS (Abbreviated Injury Scale), FSC (Full Supportive Care).

	WLST	FSC	p-Value
Any Comorbidity (n)	87.1% (2004)	92.1% (1077)	<0.001
Alcoholism (n)	10.9% (250)	4.7% (55)	<0.001
Impaired Sensorium (n)	11.5% (264)	25.4% (297)	<0.001
Diabetes (n)	21.3% (490)	17.5% (205)	0.01
Respiratory Disease (n)	15.4% (354)	17.4% (204)	0.13
Congestive Heart Failure (n)	11.6% (266)	15.8% (185)	0.001
Current Smoker (n)	11.6% (268)	9.9% (116)	0.14
Number of Comorbidities (SD)	2.5 (1.7)	2.6 (1.6)	0.01

Table 3
Patient Complications. Hospital Complications in patients who underwent WLST >24 h following injury with a head AIS < 3 compared with patients that died with full supportive measures > 24 h following injury with head AIS < 3. ICU (Intensive Care Unit), WLST (Withdrawal of Life Sustaining Therapies), CPR (Cardio-Pulmonary Resuscitation), AIS (Abbreviated Injury Scale).

	WLST	FSC	p-Value
Any Complication (n)	71.4% (1644)	41.6% (487)	<0.001
Pneumonia (n)	21.1% (485)	8.2% (96)	<0.001
Unplanned Intubation (n)	13.5% (311)	3.4% (40)	<0.001
Unplanned Return to OR (n)	3.3% (77)	0.8% (9)	<0.001
Unplanned Return to ICU (n)	6.0% (137)	3.3% (39)	<0.001
Severe Sepsis (n)	8.7% (201)	2.3% (27)	<0.001
Cardiac Arrest with CPR (n)	13.6% (313)	1.3% (15)	<0.001

Statistical analysis

Univariate analyses comparing continuous variables were performed using Student's t-tests and categorical variables were compared using chi squared and analysis of variance testing; significance assumed for $p < 0.05$. Data was analyzed using SAS (SAS Institute, Cary, NC).

Results

In the TQIP database, 3471 patients met the inclusion criteria with WLST occurring in 2301, representing 66% of study population in-hospital deaths. The mean age of the WLST group was 66.8 years, with 35.7% female, and 95.4% sustaining blunt injury. Compared with patients who died in-hospital with FSC, WLST patients were younger (67 vs 75 years p =<0.001), sustained more severe multisystem injuries as evidenced by a higher ISS (22 vs. 13, p = <0.0001) but similar AIS for head, abdomen and thorax (Table 1). WLST patients had a significantly longer hospital and ICU LOS (10.6 vs. 9.6 days; p = <0.0001, and 8.9 vs. 7.5 days; p = <0.0001) but shorter mean ventilator duration (8.2 vs. 9.2 days; p = <0.0001). The mean number of days to WLST was 9.7.

The majority of each patient group had pre-existing medical comorbidities (87.1% vs 92.1% $p < 0.001$; Table 2). While the mean number of comorbidities was similar between the two groups

(2.5 vs. 2.6 p = 0.01), as was the proportion with pre-existing pulmonary disease (15.4% vs 17.4%, p = 0.13), significant differences in comorbidity incidence were noted. In particular, pre-existing cognitive deficiency and congestive heart failure were less common, while diabetes was more common in those who underwent WLST compared to those receiving FSC (Table 2).

Despite a similar comorbidity prevalence between the two populations at baseline, the WLST group sustained significantly more in-hospital complications (71.4% vs. 41.6% p = <0.0001). Respiratory complications were particularly increased in WLST patients with nearly three times the incidence of pneumonia (21.1% vs. 8.2% p = < 0.0001) and four times the incidence of unplanned intubation (13.5% vs. 3.4% p = < 0.0001). The WLST group also more frequently underwent unplanned return to the OR (3.3% vs. 0.8% p = < 0.0001), unplanned return to the ICU (6.0% vs. 3.3% p = 0.0008), severe sepsis (8.7% vs. 2.3% p = <0.0001) and cardiac arrest with CPR (13.6% vs. 1.3% p = < 0.0001) compared to those with FSC (Table 3).

Discussion

Our retrospective analysis of injured patients who died during their index admission and underwent WLST prior to death underscores the importance of end of life care in current US trauma and critical care practice [7]. Our population excluded those with severe TBI and therefore describes a patient population for whom intensive care in and out of the ICU often leads to repair of structural and metabolic abnormalities and the potential for successful convalescence. In our study, 66% of hospitalized patients who died greater than 24 h after admission underwent WLST. This supports previous study data derived from mixed populations of injured patients [8]. The mean number of hospital days prior to engaging in WLST was longer in our cohort, but comparator studies also included patients with TBI – a group for whom the decision to pursue WLST may be more straightforward (9.7 vs. 5.4 days) [9]. The longer time metric in our data may also reflect the underpinning notion of reparability and salvage anticipated to be prevalent for those in a younger age bracket without TBI; indeed, 30% of study patients were < 55 years of age.

Statistically significant differences were apparent in comparing the demographics of WLST and FSC groups. Interestingly, the WLST cohort was significantly younger than FSC (67 vs 75 years) yet these same patients sustained greater injuries (ISS 21.6 vs 12.5). Note is made that while one group is “younger”, both groups exceed the 55 year age delimiter at which trauma mortality increases. While the reasons for differences in care utilization are inapparent from a quality database such as TQIP, it raises an important question that merits exploration. One reasonable explanation could be that in patients with less severe injury, optimism bias from the family and perhaps the treating team led to ongoing care instead of WLST despite advanced age. Additionally, in those with more severe injury, and perhaps less hope for a desirable outcome, WLST appeared to be more appropriate than continued care. The granularity required to discover the underpinnings of decision-making exceeds the extractable knowledge from TQIP. Instead, additional knowledge, such as arbiters of frailty, would be relevant in future explorations of end-of-life decision-making.

Of note is the longer total hospital and ICU lengths of stay in the WLST group. Several common observations likely explain these findings. First, the abrupt nature of injury precludes both a slow accommodation to a devastating diagnosis and the opportunity to have goals of care articulated prior to hospital admission [10]. The inherent delay in identifying a surrogate, repairing structural injuries, and allowing sufficient time to evaluate the impact of care in a group of patients without severe TBI likely explains the longer LOS between the WLST group and the group with FSC prior to death. Importantly, TQIP does not identify when the first discussion occurred about pursuing comfort cares, only the day on which life sustaining treatments were withdrawn [11]. It is unsurprising that even when the patient, family or surrogate engages in that discussion and reaches the conclusion to pursue comfort care there is an obligate period of time between discussion and action. It is perhaps in the time period between complication occurrence and recognition that survival is unlikely, or that what would be required for survival is inconsistent with the patient’s wishes, that those without TBI differ most significantly from those with TBI [12]. The former population is one for whom the hope for recovery after injury is readily embraced, while for the latter, all members of the healthcare team may more uniformly provide decision-makers with a less sanguine outlook in the face of devastating structural brain injury. This time difference is emblematic of the need to internalize and process an unanticipated outcome and represents an opportunity for external agency aid such as that of Palliative Care Medicine [13].

In our study population, patients undergoing WLST had significantly more identified in-hospital complications those with FSC, despite similar baseline comorbidities. Chief among those complications is an increased incidence of pneumonia, followed by the unplanned need for airway control, mechanical ventilation and readmission to the ICU. This sequence describes a patient population on an undesirable and most importantly, unanticipated trajectory, as does unplanned return to the OR as occurred in our WLST population [14]. This population has been most recently characterized as those in whom failure to rescue may play a prominent role [15]. While the precise etiologies of the identified acute respiratory failure and need for unplanned operations are not extractable from the TQIP database, the occurrence of this group of complications as an indication of presumed appropriate rescue therapy provides a key trigger to initiate discussions about goals of care. The authors acknowledge that a limitation of this study is that the TQIP database does not provide information about the timing of the hospital complications thus, it is possible that some of the patients had pneumonia diagnosed after the decision to withdraw life sustaining treatment occurred.

Kutcher et al. recently reported that approximately 33% of surgical rescue patients were those on the acute care surgery service already [16]. Of prime importance for the care team is the engagement of family or other surrogate decision-makers for the physiologically altered patient who has sustained a complication after injury and can no longer fully participate in a goals of care discussion. Input from surrogates is equally important whether continuing with life support measures or embarking on withdrawal of life sustaining therapy as part of comfort care [17]. Implicit in the provision of comfort care is that a clinician in conjunction with the surrogate understand that comfort care is in concert with what the patient would want for themselves if they could articulate their wishes. Given the multiplicity of responsibilities that most trauma and critical care surgeons are faced with during daytime as well as nighttime hours, many centers utilize Palliative Care Medicine (PCM) providers to span this gap and serve as a liaison between the surrogate(s) and the care team [18]. In many non-injury circumstances, early PCM intervention is associated with decreased ICU LOS, increased survival time, decreased inpatient resource utilization and improved patient and family satisfaction [19].

In our patient population, complications were more frequent in those who underwent WLST than in those with FSC. While the decision to WLST must always be individualized and carefully considered on a case by case basis, understanding that in-hospital complications often leads patients, families, or surrogates to pursue WLST could prompt earlier PCM consultation. This may

result in better patient and family satisfaction especially in the setting of acute injury when the timeframe to take advantage of these services in significantly condensed. Utilizing a well described taxonomy to facilitate clear communication and to frame such discussions enables shared decision-making [20]. Additionally, from a resource utilization standpoint, early PCM consultation may led to earlier goal setting and a shorter ICU LOS and reduced resource utilization in a way that supports patient and family centered care [21].

Conflict of interest declaration for Leonard, et al

The Authors of this manuscript declare no conflicts of interest. We have not received any funding to conduct this research.

Conclusions

Understanding the patient, injury and treatment factors that lead to the decision to pursue WLST allows patients and their decision-makers the chance to maximize autonomy and beneficence in their end-of-life decision-making. This work shows that in-hospital complications, particularly respiratory complications, are significantly more common in injured patients without severe TBI who undergo WLST despite similar baseline pre-injury comorbidities. It appears that complication occurrence during inpatient care after injury establishes a point of embarkation that may describe untoward outcomes including death. Understanding these data should inform care teams and trigger timely involvement of a Palliative Care team in end-of-life focused patient- and family-centered care.

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