



Beliefs of physician directors on the management of devastating brain injuries at the Canadian emergency department and intensive care unit interface: a national site-level survey

Croyance des directeurs médicaux sur la prise en charge des lésions cérébrales dévastatrices à la jonction entre le service d'urgence et l'unité de soins intensifs au Canada : un sondage national par établissement

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Abstract

Purpose *Insufficient evidence-based recommendations to guide care for patients with devastating brain injuries (DBIs) leave patients vulnerable to inconsistent practice at the emergency department (ED) and intensive care unit (ICU) interface. We sought to characterize the beliefs of*

Canadian emergency medicine (EM) and critical care medicine (CCM) physician site directors regarding current management practices for patients with DBI.

Methods *We conducted a cross-sectional survey of EM and CCM physician directors of adult EDs and ICUs across Canada (December 2022 to March 2023). Our primary outcome was the proportion of respondents who manage (or consult on) patients with DBI in the ED. We conducted subgroup analyses to compare beliefs of EM and CCM physicians.*

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Results Of 303 eligible respondents, we received 98 (32%) completed surveys (EM physician directors, 46; CCM physician directors, 52). Most physician directors reported participating in the decision to withdraw life-sustaining measures (WLSM) for patients with DBI in the ED (80%, $n = 78$), but 63% of these ($n = 62$) said this was infrequent. Physician directors reported that existing neuroprognostication methods are rarely sufficient to support WLSM in the ED (49%, $n = 48$) and believed that an ICU stay is required to improve confidence (99%, $n = 97$). Most (96%, $n = 94$) felt that providing caregiver visitation time prior to WLSM was a valid reason for ICU admission.

Conclusion In our survey of Canadian EM and CCM physician directors, 80% participated in WLSM in the ED for patients with DBI. Despite this, most supported ICU admission to optimize neuroprognostication and patient-centred end-of-life care, including organ donation.

Résumé

Objectif L'insuffisance des recommandations fondées sur des données probantes pour guider les soins aux individus atteints de lésions cérébrales dévastatrices rend ces personnes vulnérables à des pratiques incohérentes à la jonction entre le service des urgences et de l'unité de soins intensifs (USI). Nous avons cherché à caractériser les croyances des directeurs médicaux canadiens en médecine d'urgence et médecine de soins intensifs concernant les pratiques de prise en charge actuelles des personnes ayant subi une lésion cérébrale dévastatrice.

Méthode Nous avons réalisé un sondage transversal auprès des directeurs médicaux des urgences et des unités de soins intensifs pour adultes du Canada (décembre 2022 à mars 2023). Notre critère d'évaluation principal était la proportion de répondant-es qui prennent en charge (ou jouent un rôle de consultation auprès) des

personnes atteintes de lésions cérébrales dévastatrices à l'urgence. Nous avons effectué des analyses en sous-groupes pour comparer les croyances des médecins des urgences et des soins intensifs.

Résultats Sur les 303 personnes répondantes admissibles, 98 (32 %) ont répondu aux sondages (directions médicales des urgences, 46; directions médicales d'USI, 52). La plupart des directeurs médicaux ont déclaré avoir participé à la décision de retirer des traitements de maintien des fonctions vitales (TFMV) pour des patient-es atteint-es de lésions cérébrales dévastatrices à l'urgence (80 %, $n = 78$), mais 63 % ($n = 62$) ont déclaré que c'était peu fréquent. Les directions médicales ont indiqué que les méthodes de neuropronostic existantes sont rarement suffisantes pour appuyer le retrait des TMFV à l'urgence (49 %, $n = 48$) et croyaient qu'un séjour aux soins intensifs était nécessaire pour améliorer leur confiance en ces méthodes (99 %, $n = 97$). La plupart (96 %, $n = 94$) estimaient que le fait d'offrir du temps de visite aux personnes soignantes avant le retrait des TMFV était un motif valable d'admission aux soins intensifs.

Conclusion Dans le cadre de notre sondage mené auprès des directions médicales des services d'urgence et des USI au Canada, 80 % d'entre elles ont participé au retrait de TMFV à l'urgence pour des patient-es souffrant de lésions cérébrales dévastatrices. Malgré cela, la plupart d'entre elles étaient en faveur d'une admission aux soins intensifs afin d'optimiser le neuropronostic et les soins de fin de vie axés sur les patient-es, y compris le don d'organes.

Keywords devastating brain injuries · neuroprognostication · survey

A devastating brain injury (DBI) occurs when there is a life-threatening neurologic insult with a high probability of death or profound functional impairment.^{1,2} Common

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etiologies include traumatic brain injury, cerebrovascular accidents, and hypoxic brain injuries. Typically, patients with acute DBI are initially assessed in the emergency department (ED). Despite an initial minimally conscious state, some patients improve when stabilized and observed in an intensive care unit (ICU).^{3,4} Prediction of survival varies between ICU team members and can be incorrect 15% of the time.⁵ The majority of death in patients with DBI is linked to the decision to withhold or withdraw life-sustaining measures (WLSM), and as such, it is difficult to ascertain if death is unavoidable or the consequence of a clinical decision.⁶ Thus, premature neurologic prognostication is increasingly recognized as a potential threat to this vulnerable population and recommended against.^{1,7,8}

Evidence-based neuroprognostication strategies are limited.^{9,10} Variability in WLSM practices for patients with severe traumatic brain injury have been observed across Canada, including variability in use and utility of prognostic models and diagnostic tests.¹¹ Uncertainty exists regarding optimal timing of prognostic evaluation.^{8,12} Delaying the decision to WLSM also facilitates engagement of organ and tissue donation programs. Recognizing that neuroprognostication in DBI in the first hours following hospitalization can be error prone, a joint position statement from the Canadian Association of Emergency Physicians (CAEP), Canadian Critical Care Society (CCCS), and Canadian Neurological Sciences Federation (CNSF) was published which recommends managing patients with DBI in an ICU setting to optimize neuroprognostication, organ donation team engagement, and patient-centred end-of-life care.¹³ Health care teams within the ICU have unique expertise in providing compassionate palliative care during WLSM and/or facilitating organ donation after cardiac determination of death.^{14,15} There is scant emergency medicine (EM)-specific literature to guide palliative care in the ED with expert consensus recognizing that EDs are not the ideal setting for this phase of care.¹⁶

On the basis of the above, we sought to characterize beliefs regarding neuroprognostication and management practices by EM and critical care medicine (CCM) physicians for patients with DBI at the ED/ICU interface and identifies practical facilitators and barriers to implementation of best-practice recommendations.

Methods

Study design and setting

We conducted an electronic, cross-sectional survey of EM and CCM physician directors of adult EDs and ICUs across

Canada. We excluded pediatric settings because of differences between adult and pediatric DBI management, as nearly all pediatric DBI patients across Canada are transferred to pediatric ICUs as soon as possible and not managed in regional centres. We targeted EM and CCM physician site directors at respective sites as representatives of the average clinical practice beliefs given their engagement in local policies and standards of care. A master contact list was generated that included 303 potential ED and ICU physician site directors in Canada from diverse practice settings. Where available, we ensured that both ED and ICU directors at the same sites were targeted. Our list of ED site directors was generated from searching staff directories of individual hospitals, health service delivery organizations, and universities. The Canadian Critical Care Trials Group provided us with a list of ICU directors, which we similarly updated and validated via hand searching relevant online staff directories.

Survey instrument

We designed our questionnaire following standard methodologies.^{17,18} Items were generated iteratively through a combination of literature review and discussion with collaborators until thematic saturation was achieved. We used a modified Delphi technique for item reduction. We pilot tested the questionnaire with resident physicians from EM and CCM prior to dissemination. The questionnaire was formatted as intended for dissemination and co-investigators assessed the face and content validity, comprehensiveness, and clarity of the survey. We translated and back-translated the survey from English to French (Electronic Supplementary Material [ESM] eAppendix). We disseminated the survey using Interceptum software (Acquiro Systems, Inc., Gatineau, QC, Canada).

Survey administration and dissemination

We sent an initial personalized introductory letter and invitation to participate, along with an unconditional incentive (a CAD 5 coffee gift card), to all potential respondents. Nonrespondents received up to three e-mail reminders at two-week intervals. We disseminated the survey from December 2022 to March 2023. Survey completion was voluntary, and responses were not linked to respondent identity. A consent disclosure statement was included in the invitation to participate, and subsequent survey completion represented informed consent. We obtained approval from the University of Manitoba Health Research Ethics Board for this study (Winnipeg, MB, Canada; #HS25242).

Outcomes

Our primary outcome was the proportion of respondents who had experience with WLSM for patients with DBI while in the ED. Secondary outcomes included respondent demographics, described neuroprognostication and management practices for patients with DBI at the ED/ICU interface (e.g., respondent beliefs about neuroprognostication methods, consultation practices, duration of observation for neuroprognostication, etc.), awareness of current recommendations, and facilitators or barriers to ICU admission for patients with DBI.

Statistical analysis

Categorical item responses are presented as numbers and proportions. We conducted *a priori* planned subgroup analyses to compare beliefs of EM and CCM physicians.

Results

Survey invitations were sent to 303 potential respondents. Of the 117 surveys returned, 19 were excluded based on the respondent stating that they do not manage (or consult on) adult patients with DBI. Results were analyzed from 98 completed surveys (EM physician directors, 46; CCM physician directors, 52), representing a response rate of 32%. Respondents were asked to reply according to routine clinical practices at their site rather than their personal practice. Survey respondents were practicing physician site directors of EDs (47%, $n = 46$) and ICUs (53%, $n = 52$) in Canadian centres. A minority of respondents were women (28%, $n = 27$) and almost half were senior clinicians in practice > 15 years (45%, $n = 44$). Respondent demographics are summarized in Table 1.

Withdrawal of life-sustaining measures in the emergency department

All respondents confirmed their site evaluates and manages adult patients with DBI in the ED (100%, $n = 98$). Most physician directors reported participating in WLSM for patients with DBI in the ED (80%, $n = 78$); however, 63% ($n = 62$) said they did so infrequently. A minority of EM and CCM physician directors reported never participating in WLSM in the ED for patients with DBI where neurologic prognosis is deemed unfavourable (Table 2).

Neuroprognostication

Most respondents indicated existing neuroprognostication methods are infrequently (49%, $n = 48$) or never

(21%, $n = 21$) sufficient to inform a recommendation for WLSM in the ED (ESM eTable 1). Nearly all respondents felt additional time to improve confidence in neuroprognostication is a valid reason for a patient with DBI to be admitted to an ICU (99%, $n = 97$). Emergency medicine directors (62%, $n = 28$) reported often or always consulting the ICU for admission to facilitate neuroprognostication (ESM eTable 2). The majority of CCM directors (81%, $n = 42$) reported always or often being consulted for the same reason. Over half of CCM directors felt that an observation period of greater than 48 hr should be offered prior to WLSM (54%, $n = 28$). A majority of CCM directors reported involving additional services during an ICU admission for patients with DBI (ESM eTable 3).

End-of-life care

Nearly all respondents felt admission of a patient with a DBI to an ICU was a valid decision to provide an opportunity for the family or substitute decision maker (SDM) to process information and visit prior to WLSM (96%, $n = 94$), while also providing time for patient-centred palliative care (82%, $n = 80$). Under half of EM directors (47%, $n = 21$), however, said they often or always consulted the ICU to facilitate patient-centred palliative care for patients with DBI (ESM eTable 4). In contrast, most CCM directors (79%, $n = 38$) reported often or always admitting patients with DBI to their ICU to facilitate patient-centred palliative care. Most CCM directors (85%, $n = 44$) endorsed the opportunity for enhanced patient-centred palliative care as a facilitator of ICU admission *vs* less than half of EM directors (41%, $n = 19$). Most CCM respondents reported consultation with social work (71%, $n = 37$), spiritual care (62%, $n = 32$), and cultural support services (50%, $n = 26$) for patients admitted to an ICU with DBI.

Organ donation

Most respondents (91%, $n = 89$) reported an opportunity for engagement of an organ donation service as an added benefit of an ICU admission *vs* WLSM in the ED for patients with DBI. Most CCM directors (58%, $n = 30$) reported that, for a patient with a DBI and poor neurologic prognosis, SDM interest in organ donation would make them more likely to offer ICU admission (ESM eTable 5). Most CCM directors (84%, $n = 41$) reported often or always admitting patients with DBI to their ICU to preserve the potential for organ donation (ESM eTable 6) and to facilitate patient-centred palliative care. We asked respondents to consider a patient presenting with acute DBI, impending respiratory failure, and previously

Table 1 Respondent demographics

Demographic	Number of physician directors, <i>n</i> /total <i>N</i> (%)	
Clinical specialty		
Emergency medicine	46/98 (47%)	
Critical care medicine	52/98 (53%)	
Gender		
Women	27/98 (28%)	
Men	66/98 (67%)	
Nonbinary/prefer not to disclose	< 5	
Practice location		
British Columbia	16/98 (16%)	
Alberta	10/98 (10%)	
Saskatchewan	8/98 (8%)	
Manitoba	11/98 (11%)	
Ontario	28/98 (29%)	
Quebec	17/98 (17%)	
Atlantic Provinces	6/98 (6%)	
Territories	< 5	
ICU type on site		
	<i>EM</i>	<i>CCM</i>
None	7/46 (15%)	–
Medical	14/46 (30%)	9/52 (17%)
Surgical	6/46 (13%)	6/52 (12%)
Mixed	25/46 (54%)	47/52 (90%)
Neurosurgical	6/46 (13%)	11/52 (21%)
Trauma	7/46 (15%)	14/52 (27%)
Cardiac	11/46 (24%)	12/52 (23%)
Other	2/46 (4%)	1/52 (2%)
Duration of practice		
0–10 years	24/98 (24%)	
11–15 years	30/98 (31%)	
> 15 years	44/98 (45%)	

CCM = critical care medicine physician directors, EM = emergency medicine physician directors, ICU = intensive care unit

expressed goals of care that preclude mechanical ventilation, who has also registered an intent to donate their organs (which requires mechanical ventilation). With these competing interests in mind, 41% (*n* = 40) of respondents reported that they would not consider intubation as the goals of care supersede the intention to donate organs, 41% (*n* = 40) reported that they would attempt to delay intubation while seeking clarification from a SDM, 13% (*n* = 13) reported that they would intubate then seek clarification from a SDM, and 4% (*n* = 4) reported that they would intubate because the organ donation wish supersedes the goals of care that precluded mechanical ventilation.

Facilitators and barriers

Over twice the proportion of CCM physician directors felt that the ICU offered a better palliative care environment than the ED (CCM 85%, *n* = 44; EM 41%, *n* = 19). More CCM respondents also indicated that SDM requests for organ donation team engagement facilitated ICU admission (CCM physician directors, 73%, *n* = 38; EM physician directors, 52%, *n* = 24) (ESM eTable 7). Consultant certainty of a poor prognosis was endorsed as a barrier to ICU admission by more EM physician director (63%, *n* = 29) than CCM physician director (50%, *n* = 26) respondents, as was consultant recommendation for palliation (EM 59%, *n* = 27; CCM 42%, *n* = 22). Twice the proportion of EM physician director respondents endorsed difficulty finding an accepting physician when transfer for ICU admission is required (EM physician directors, 30%, *n* = 14; CCM physician directors, 15%, *n* = 8). Emergency medicine physician director respondents were more likely to endorse both ICU and ED resources being strained as a barrier to ICU admission for patients with DBI (ESM eTables 8 and 9). Most respondents (87%, *n* = 85) were not aware of the existence of the CAEP/CCCS/CNSF joint position statement on the management of DBI (ESM eTables 10 and 11).

Discussion

In our survey of Canadian EM and CCM physician directors, most respondents reported participating in WLSM for patients with DBI in the ED. For most, WLSM in the ED was infrequent. Most felt ICU admission was appropriate for patients with DBI to facilitate prognostication and level of care decisions, patient-centred end-of-life care, and/or engagement of organ donation teams. Nevertheless, over half of respondents identified both “consultant certainty of poor prognosis” and “consultant recommendation for palliation” to be a barrier to ICU admission after DBI. An appreciation of the benefits of ICU admission for patients with DBI with attempts to enhance collaborative conversations between EM and CCM may serve to standardize care to achieve best practices for those with DBI in our communities.

Neuroprognostication

Most respondents indicated that existing neuroprognostication methods were insufficient to inform a decision to WLSM in the ED following DBI. Nevertheless, the majority reported participating in WLSM in the ED (often or infrequently) with nearly twice the number of EM respondents reporting “often”

Table 2 Respondents reporting having participated in the withdrawal of life-sustaining measures in the emergency department when the neurologic prognosis was deemed devastating

Response	Proportion of EM physician directors <i>N</i> = 46	Proportion of CCM physician directors <i>N</i> = 52
Always	0% (<i>n</i> = 0)	0% (<i>n</i> = 0)
Often	22% (<i>n</i> = 10)	12% (<i>n</i> = 6)
Infrequently	57% (<i>n</i> = 26)	69% (<i>n</i> = 36)
Never	22% (<i>n</i> = 10)	19% (<i>n</i> = 10)

CCM = critical care medicine, EM = emergency medicine

participating in WLSM in the ED compared with “infrequently.” Accurate neuroprognostication in patients with DBI requires a known, proximate cause for the injury (i.e., a diagnosis compatible with DBI).¹⁹ To obtain an accurate prognosis from the clinical exam validly, confounding variables must first be resolved (e.g., drug clearance, core temperature, metabolic derangements, hemodynamic stability).²⁰ A recent systematic review showed that patients who are comatose with absent brainstem reflexes, immediately following resuscitation from a cardiac arrest, can subsequently regain neurologic function.¹² Recognizing that neurologic assessments can be unreliable in the acute postresuscitative phase following a cardiac arrest has led to professional standards that mandate an observation period of at least 72 hr after return of spontaneous circulation (ROSC) and before neuroprognostication.^{21–23} For patients with DBI and a devastating structural abnormality in the brain confirmed with neuroimaging, recommendations allow for a neuroprognostic examination once potential confounders are resolved, but supporting standards are variable ranging from 4 to 72 hr depending on the etiology of the DBI.²⁰ New Canadian guidelines recommend a minimum 48-hr observation period post-ROSC for patients without imaging evidence of a DBI prior to a determination of death via neurologic criteria.⁸ Admission to an ICU following DBI allows the time needed to resolve confounders of the neurologic exam, ensure the patient is evaluated by specialized clinicians, obtain specialized ancillary neuroimaging if appropriate, and make the most accurate neurologic prognosis possible.^{7,13} Our survey has identified a gap between these recommendations and reported clinical practice, as per ED and CCM physician directors. There is agreement that existing neuroprognostication methods may be insufficient to inform WLSM in the ED, yet less than two thirds of EM directors endorsed typically consulting CCM physicians for ICU admission to facilitate what almost all respondents endorsed as an appropriate indication.

End-of-life care

Respondents endorsed high-quality, patient-centred end-of-life care as a benefit of ICU admission. The extant literature supports greater satisfaction among caregivers with quality end-of-life care offered within the ICU compared with other departments.²⁴ Among Canadians who died in hospital (in which the ICU was the most common location), 67% of family members were very or completely satisfied with the overall quality of care their relative received in the last month of their life.²⁵ Despite this recognition, most EM physician directors did not report routine consultation to the ICU for patients with DBI for patient-centred palliative care. In contrast, the majority of CCM physician directors reported always or often admitting patients with DBI for this indication at their site. In fact, over twice as many EM respondents endorsed the opportunity for enhanced patient-centred palliative care as a facilitator of ICU admission. Most CCM physician director respondents reported consultation with social work, spiritual care, and other cultural support services for patients admitted to ICUs with DBI, reflecting a capacity for multidisciplinary patient-centred end-of-life care that may not be available in the ED. This practice gap represents an opportunity for discussions between EM and CCM practitioners around the benefits of ICU admission for patients with DBI and their caregivers that extend beyond neuroprognostication to include patient-centred end-of-life care. Interestingly, a minority of CCM physician director respondents reported consulting the palliative care service during the provision of end-of-life care in the ICU. We hypothesize that most CCM providers have expertise in providing end-of-life care acutely in the peri-WLSM period and likely consult specialized palliative care teams only when ongoing palliative care over days or weeks is anticipated.

Organ donation

Most CCM physician director respondents indicated consultation with the organ donation team in patients admitted with DBI was a typical part of their practice. The opportunity to identify potential organ donors has been noted as a secondary benefit of an ICU admission following a DBI.¹³ Prompt referral and physiologic support of potential organ donors allows time and opportunity for donation.²⁶ Early referral to organ donation services is associated with an increased likelihood of successful organ recovery.²⁷

Interest in organ donation expressed by SDMs made most respondents more likely to pursue or offer ICU admission. There was variation in practice regarding a decision to provide mechanical ventilation acutely when

pre-existing goals of care preclude it, but conflict with pre-existing wishes to donate organs. These findings expose important targets for education. While an expression of interest in organ donation might delay a decision to WLSM, admission to an ICU and access to critical care services should not be contingent on patient or SDM interest in organ donation. Although organ donation may be a secondary benefit, the decision on whether critical care interventions are appropriate is individualized and combines patient wishes with clinical suitability. Our findings of differential reported access to ICU contingent on interest in organ donation (and inconsistent practice when competing priorities between acceptability of mechanical ventilation and desire for organ donation exist) support a need for further education.

Facilitators and barriers

Respondents endorsed age, rural/northern/remote location of primary residence, low levels of health literacy and social marginalization as the top four equity-relevant barriers for patients with DBI to access ICU care. We found a higher proportion of EM physician directors willing to withhold or WLSM in the ED compared with CCM directors. Additionally, rural location was identified as the top barrier to ICU access outside of age. Rural patients with DBI and without easy access to ICU consultation services represent a population with unique barriers to accessing critical care and vulnerable to differential treatment. Epidemiologic studies have similarly supported decreased ICU use and access for patients who are elderly, rural-dwelling, or have a low socioeconomic status.²⁸ The impact of social determinants of health on outcomes for critically ill patients are complex and remain incompletely understood. Race, ethnicity, gender identity, and sexual orientation have additionally been associated with disparities in ICU care.^{29–32} The routine systematic, coordinated, and standardized collection of sociodemographic variables for critically ill patients with DBI presenting to EDs is needed for clinical systems to be able to measure and monitor social identity-based inequities in care.³³ Differential use of the ICU between rural and urban populations may not be exclusively due to barriers to access. Comparative analyses on differences in patient values and minimum acceptable outcomes with respect to brain injury, advanced life support, and quality of life may shed further light on reasons why individuals may actively choose not to pursue critical care in different circumstances.

Strengths and limitations

Our survey studied both EM and CCM physician directors across Canada with respect to the management of DBI at the ED/ICU interface; sampling of both specialties who most frequently encounter DBI within hospital systems is a strength of our study. Further, respondents represented diversity in geography and practice setting.

Limitations of our study include the potential for response bias inherent in surveys that are voluntary and depend on respondent recollection for self-reported responses. Our response rate (32%) was lower than our goal, which limits the generalizability of the results. Further, responses provided were of reported practice by physician directors of their respective EDs or ICUs, which may not necessarily reflect actual clinical practice of the entire clinical group that they represent. Also, we did not explore the perspectives and practices of neurologists and neurosurgeons who may also be involved in neuroprognostic decisions and may be outside these knowledge translation circles.

Conclusion

In our survey, we observed that most Canadian EM and CCM physician directors participated in WLSM for patients with DBI in the ED. Most supported ICU admission for these patients to optimize neuroprognostication and facilitate patient-centred end-of-life care, including organ donation (when appropriate). Discrepancies between EM and CCM directors in perceived facilitators and barriers to ICU admission for patients with DBI represent a focus point for quality improvement, knowledge exchange, and collaboration.

Author contributions Piotr Wtorek, Murdoch Leeies, and Jehan Lalani contributed to all aspects of this manuscript, including study conception and design; acquisition, analysis, and interpretation of data; and drafting the article. Matthew J. Weiss, Jeffrey M. Singh, Carmen Hrymak, Aleks Chochinov, Brian Grunau, Bojan Paunovic, Sam D. Shemie, James Stempien, Patrick Archambault, and Rob Fowler contributed to the conception and design of the study. Bailey Piggott contributed to the analysis of the data. Parisa Seleseh contributed to the acquisition of data.

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