ANATOMICAL PERSPECTIVE OF BRAIN STEM DEATH

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BSD is defined as irreversible loss of consciousness, capacity to breathe and integrated functioning \(^1,^2\)

BSD patients classically manifests with a deep coma, absence of brainstem reflexes and apnea \(^1\)

No universal definition of death, brain death or brain stem death \(^1,^2,^3\)

1. Wijdics 2001
2. Greer et al. 2008
3. Mathur et al. 2008
Classically, death defined as loss of heart and lung function \(^4,5\)

UDDA definition(1980): irreversible cessation of all functions of the entire brain including the brainstem

UDDA an improvement of the classical definition but unsatisfactory \(^2,3,4,\)

\(^4\) Morrison, 1971  
\(^5\) Bernat et al., 1981
INTRODUCTION (3)

- Vast amount of information available on the cellular and molecular mechanisms of death 5,6,7

- Studies have rarely focused on understanding of BSD

- Major discrepancies have been noted in the diagnostic criteria for BSD 1,2,8

- Accurate understanding of BSD important in this era of increased demand for organ transplantation and effective CPR

AIM

- Literature review on:
  1. Historical perspectives of the definition of BSD
  2. Anatomy behind the cardinal features of BSD namely a deep coma, absence of brain stem reflexes and apnea.

- Such to form a basis for a research project
METHODS

- A search of English literature using Google scholar™, Pubmed and HINARI

- Search items: ‘death’, ‘brainstem death’ and ‘brainstem reflexes’
HISTORICAL ASPECT

- 1959: *Coma dépassé* 9
- 1965: ‘brain dead’ used to describe a patient with a heart beat 10
- 1968: Harvard Medical School committee definition
- 1971: damage to the brain stem as a critical component of severe brain damage 11
- 1978: deep unresponsive coma and absence of brain stem function
- 1981: UDDA

ANATOMY OF THE CARDINAL FEATURES OF BSD

COMA

- State of unrousable unconsciousness ¹³

- Anatomic and metabolic considerations predispose the brain to permanent damage ¹⁴

- Occurs when RAS disrupted at or below level of tentorium cerebelli ¹⁵

¹³ Laureys et al., 2001 ¹⁴ Plum et al., 1980 ¹⁵ Plum et al., 1980
**BRAIN STEM REFLEXES**: The pupillary light reflex

- BS areas controlling consciousness are anatomically adjacent to those controlling pupillary responses \(^{16}\)

- Fixed dilated pupils in comatose patient ominous sign if reversible causes of coma have been excluded \(^{17}\)

- Limitation: variability in the normal light reflex and testing conditions \(^{18}\)

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16. Ishiguro et al., 1992
17. conference of the Royal Colleges and Faculties of the United Kingdom, 1976
18. Ellis, 1981
APNEA

- Documents absence of breath at appropriate pCO2

- Anatomical site involved: ventral medulla chemoreceptors

- Limitation: Hypotension, hypoxia and acidosis

19. Saposnik et al., 2000
20. Saposnik et al., 2004
CEREBRAL BLOOD FLOW

- The arrest of CBF secondary but important phenomenon of BSD 21
- Standard for diagnosis: four vessel angiography 22,23,24
- Limitation: persistent CBF 25

22. Bradac and Simon, 1973  
23. Bluemke and Chambers; 1995  
24. Dupas et al., 1998  
25. Flowers et al., 2000)
LIMITATIONS

- Persistent cortical, subcortical or brainstem function in BSD patients

- Intact HP axis, presence of bowel sounds, autonomic reflexes (tachycardia and hypertension)

26. Doig and Burgess; 2003
27. Lamb, 1985,
28. Halevy and Brody, 1993
CONCLUSION

- No consensus on behavior of a BSD patient
- Need for animal models for study of mechanisms of BSD
- Whatever the future arguments, a sound knowledge of the anatomical basis of BSD would be necessary so as to appreciate this complex yet paramount concept


ASANTE
(THANK YOU)