ORIGINAL ARTICLE

Assessment of Mortality as a Reliable Measure of Neurosurgical Care

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ABSTRACT

Aim: To assess Mortality as a reliable measure of Neurosurgical care.
Methods: We analyzed hospital mortality records of 7 years i.e., from January, 2009 to January 2016. In addition, information on outpatient visits, admissions, and procedures was gathered. A detailed review of fatalities was done. According to predetermined standards, fatalities were classified as accidental, theoretically avoidable, or avoidable.
Results: Over the time frame observed, 200 people died. In that time frame, 0.96% of patients were admitted, and fewer than 0.3% of patients received neurosurgical treatment. The overwhelming number of neurosurgical fatalities is inevitable, with the main pathology determining survival more than the standard of treatment given. Just seven deaths were considered theoretically avoidable (0.03% of admissions), although none of them may have been avoided with proper neurosurgical treatment.
Conclusion: The mortality rates in neurosurgery do not represent the quality of treatment given. The majority of fatalities in neurosurgery are accidental, with key pathology determining mortality rather than the level of treatment given. Focusing only on death avoids the fact that more than 99% of people admitted for neurosurgery do not die.
Keywords: Neurosurgery care, complications, avoidable deaths, Mortality, successful discharge

INTRODUCTION

The death rate is believed to be a useful metric that patients, their relatives, physicians, and other health-care professionals may use to assess and enhance healthcare services.[1, 2]The drastic drop in cardiac surgery mortality rates after the announcement of the mortality rate has been promising. The Neurosurgical National Audit Programme (NNAP) was established in 2013 by the Society of British Neurological Surgeons (SBNS) to develop databases, audits, and registries that will provide credible evidence for effective assessments and monitoring as part of a new quality assurance effort to enhance patient treatment, outcomes, protection, and experience.[3]In 2015, NHS England launched the Consultant Result Publication (COP) to improve clarity within the NHS and offer updates on surgical results to the general public[4].

The basic principle was that the mortality rate would represent the standard of treatment and provide an impression of the surgeon's capabilities.[5, 6]Although this might be valid of certain specialties, we have shown that in neurosurgery, the aetiology of the illness and the presenting pathological state have a greater impact on mortality than the surgeon's competence or knowledge. We conducted this analysis to evaluate this theory, measure mortality rates from our hospital records, and determine the factors leading to it since there is no data available about whether mortality is a strong predictor of the standard of treatment in neurosurgery. In a high-volume centre, applied benchmarking systems in the United Kingdom and the United States struggle to find a significant amount of problems. Outcome associations between most centres and actual surgeons remain dubious if dependent on these systems, but health care officials should be careful.

Received on 05-02-2020
Accepted on 13-03-2021

MATERIALS AND METHODS

From January 2009 to January 2016, we looked at the hospital's report for mortality, emergency and elective patients, outpatient clinic attendants, emergency and elective procedures, and on-call referrals from outside the hospital. Information of the cause of death, specialist subspecialties, admission condition, if there was any medical operation, original GCS at diagnosis, and the patient's age were all examined in greater detail for 200 cases from January 2012 to January 2016.

According to Teixeira et al guidelines, death causes is grouped into three categories: avoidable, theoretically avoidable, and inevitable[7]. The term "avoidable accidents" was used to describe cases in which a medical mistake resulted in a patient's death. Unavoidable accidents occurred as death was suspected amid existing medical intervention standards.

RESULTS

According to hospital reports, we had 33,263 admissions between January 2009 and January 2016, including 27.4% non-elective admissions, 50.5% elective admissions, and 22.1% day cases; 123,719 patients were seen in multiple neurosurgery subspecialties outpatient clinics. We received 38,790 medical referrals and performed 26,755 operations, 22.75% of which were emergency / non-elective procedures, 54.9% elective surgeries, and 22.35% day-case procedures. During this period we had a total of 667 neurosurgery deaths, which represented 2% of the total admissions under the neurosurgery and 0.34% of the scope of neurosurgery practice (admissions (whether or not they had surgery), outpatient attends, emergency attends and emergency referrals, day cases). Our analysis showed that we had 200 mortality cases from January 2012 till January 2016 representing 0.94% of the number of patients admitted under neurosurgery and 0.16% of the scope of our neurosurgery practice in the same period.

Results plotted from both databases reflect a decrease in the overall mortality rate of our department over the years. The department database showed a steady decrease till 2013 followed by a period of a plateau, the trust database showed a steady decrease with a steep decrease between 2012 and 2014 followed by a minimal increase in mortality rate. On cross-checking, the department mortality rate with the trust held mortality rates, although both showed an overall decrease in the mortality rate; we detected 26-59% error rates. Interestingly, neither of these databases results corresponds with the NNAP results, which could indicate that the data used to populate national mortality rates might have very high error rates.

When we looked at these 200 mortalities from the neurosurgery subspecialties, we found that most of the deaths were predetermined by the primary pathology, and the clinical presentation rather than the quality of care provided. The majority of these deaths are unavoidable, with more than one third due to trauma, followed by patients with neurovascular pathologies, and then patients in neuro-oncology. This also means that in large units with multiple subspecialties there will be great differences in mortality rates between subspecialties; for example, the mortality rate of a neurosurgeon specializing in neurovascular pathology will be much higher than one specializing in the complex spine. This creates an added difficulty in standardizing the mortality rate and adequately using it for comparison.

Out of the 200 mortality cases we analyzed, we found that 93% of these occurred after an emergency admission, and 40% of these died without having any further neurosurgical intervention. Out of these 200 cases, there were no deaths that were deemed avoidable and there were only seven deaths that were deemed potentially avoidable. Of these, 5 occurred after elective admission. These 7 cases represent (0.033%) of admission under neurosurgery care from January 2012 till January 2016, and representing (0.0056%) of the whole scope of neurosurgery provided over the same period.

These seven potentially avoidable deaths (where more optimal delivery of care might have affected the outcome), are scenarios that are familiar to all the neurosurgeons and it is always debatable if they are avoidable or not. During the studied period, we did recollect one death where the trust had admitted liability; i.e.it was an avoidable death. Interestingly this death didn't appear in either of the databases searched. This is further evidence of the inaccuracies in the formal data collection processes.

Table 1: Numbers and distribution of patients admitted in our trust from January 2009 till January 2016.

Jan 2009-Jan 2016	Elective	Non Elective (emergency)	Day case	Total
Admissions	16,798	9,114	7,351	33,263
Surgical procedures	14,688	6,087	5,980	26,755

Figure 1: **N**eurosurgical mortality, admissions, OPD attends, emergency attends, operations from Jan 2009 – Jan 2016.

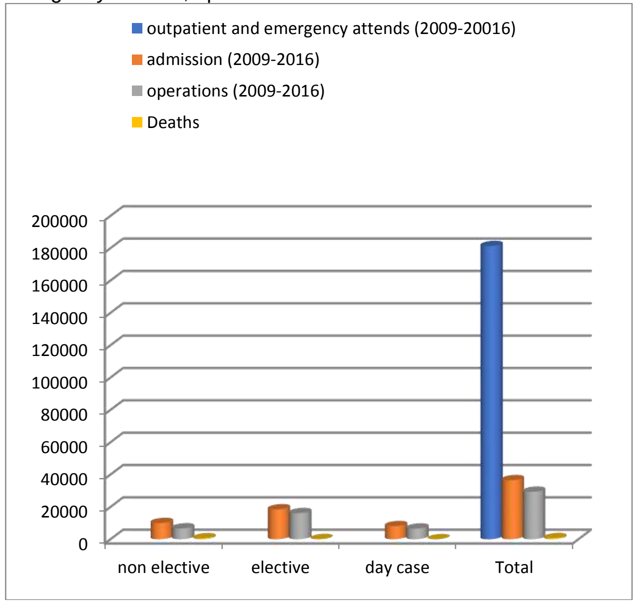

Figure 2: **A** decrease in mortality rates over the years and a discrepancy between the department held and trust held databases.

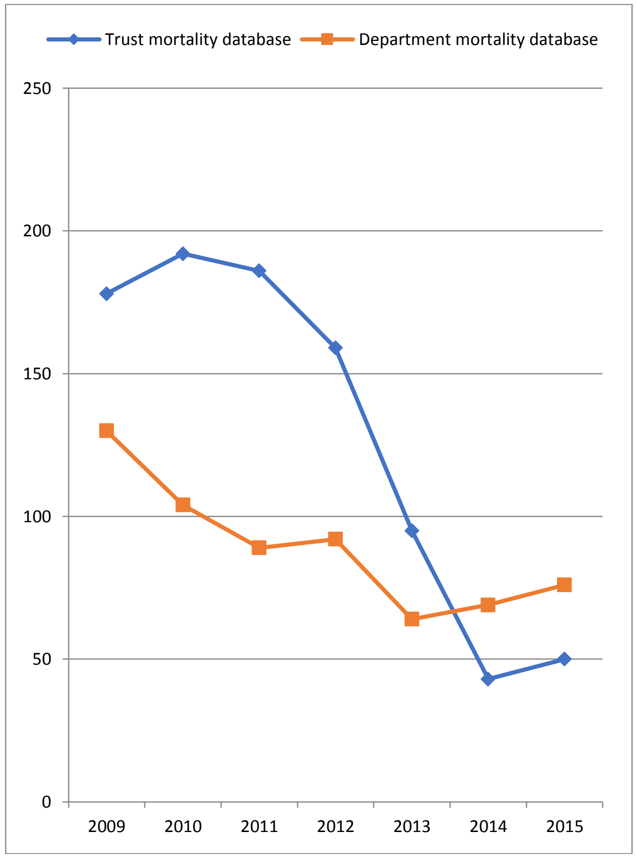

Figure 3**: V**arious causes of death of the 200 mortality cases

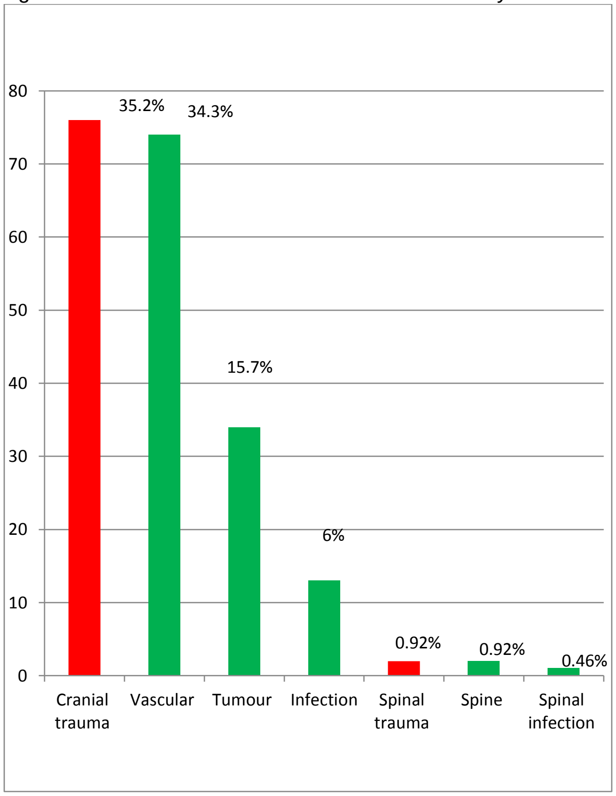

Table 2: Difference between department and trust data on mortality

Year	Trust Data	Department data	Difference	%age
2009	178	130	48	41
2010	192	104	88	59
2011	186	89	97	26
2012	159	92	67	36
2013	95	64	31	33
2014	43	69	26	38
2015	50	76	26	34
Total	903	624	279	100
Average	129	89	55	38
Median	159	89	56	36
Minimum	43	64	26	26
Maximum	192	130	97	59

Table 3**:** Cases with potentially avoidable deaths

CPA vestibular schwannoma in 80y old	Should tumour surgery have been avoided and a shunt placed instead?
NF2 patient, multiple intracranial tumours with increased ICP	Inadequate placement of shunt
Acute subdural haematoma	Delay in evacuation
Chiari malformation	Sub optimal foramen magnum decompression, post op respiratory and motor problems
Left large sphenoid wing meningioma	Delay in decompressive craniectomy
Vestibular schwannoma	Misplaced shunt led to a series of other complications
Acute subdural haematoma	Inadequate decompression

DISCUSSION

There are few developed methods that are used to assess the applicability of these programmes for quality benchmarking and estimate sample sizes used for reliable quality comparisons[8]. In-hospital major and minor morbidity rates were 18.7% and 38%, respectively, with a 2.4% 30-day mortality rate. The NSQIP criterion correctly classified 96.2% of major complications, but just 38.4% of minor complications. While N2QOD performed well, nearly a quarter (23.2%) of all patients with adverse effects, most of whom were mild, went unnoticed. Due to the low mortality rates, NNAP needs a sample size of over 4200 patients per surgeon to identify a 50% rise in mortality rates amongst surgeons. The sample size needed to make accurate distinctions between rates of complications is greater than 600 patients a year per centre[8]. Varying mortality rates in neurosurgery have been reported in several studies. Sandeman et al in reported that during 15 years for 1 Consultant in Bristol there were 6006 admissions in which an overall mortality rate was seen as 2.7%[9]. Few more studies reported that the mortality rate was observed from 1.7%[5] to 4.52%neurosurgical procedures[10].

Some authors have reported the mortality rates to be different in elective and emergency cases and the majority have reported emergency work mortality to be much higher than elective ones[11,12]. Studies reported that there are many postoperative complications[13,14] in which the common complications were reoperation, venous thromboembolism with percentage of 5.1% and 3.5% respectively. The reasons for reoperation were intracranial haemorrhageas 18.5% and complications due to wound as 11.9%. The death rate was 2.6%[13].

CONCLUSION

Most fatalities in neurosurgery are inevitable and predetermined by the presenting anatomy, but mortality rates should not represent the quality of treatment given. The amount of avoidable / possibly avoidable death in our hospital is less than 0.006% of the total amount of neurosurgical treatment given. Mortality rates in different subspecialties in neurosurgery would be extremely volatile, making mortality rates alone an inaccurate and flawed comparative parameter. The error rate in mortality databases seems to be strong. When reviewing the patient's records, we discovered that there were more preventable issues that resulted in morbidity in the patients than fatalities. We believe that combining the morbidity index with the death rate will be a more

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