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Does the Timing of Acute Type A Aortic Dissection Surgery Impact on Immediate and Long Term Patient Outcomes? A Retrospective Single Centre Study

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Abstract

Introduction: Type A aortic dissection is a surgical emergency which traditionally has been treated with surgery as soon as possible. There have been recent reports suggesting that outcomes of surgery might be worse if carried out during the night.

Methods: All patients operated on over a ten year period for Type A aortic dissection in our department were included in the study and followed up to date.

Results: 96 operations were performed for type A aortic dissection at Castle Hill Hospital between 2008 to 2018 with 56 performed during the day and 40 at night time. There was most a difference in long term mortality between 4 to 7 years after surgery in favor of day time cases which equalized beyond 7 years.

Conclusion: Consideration should be given to delay of surgery for Type A aortic dissection to day time rather than operating as an emergency during the night.

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Introduction

Type A aortic dissection is a life threatening surgical emergency. A predicted increase of 1% mortality for every hour surgery is delayed is commonly quoted in the literature [1-3]. Patients are often rushed to theatre for emergency surgery during unsociable hours. Amongst many surgical disciplines there has been a shift in practice to favor performing high risk procedures during working hours where units are appropriately staffed-given the patient remains clinically stable [4-6]. Important human factors must be considered when undertaking complex procedures out of hours; fatigue and impaired concentration may lead to compromised decision making and execution of technical skills [6]. Aortic dissection surgery is a notoriously lengthy, laborious and precarious operation, which ideally should be performed by an alert multi-disciplinary unit. Data from Beijing suggests that of 698 patients who underwent surgery for type A aortic dissection, night time surgeries carried significantly increased morbidity and mortality compared with day time surgery including; in hospital mortality (12.08% *vs.* 6.42%), reintubation and renal replacement therapy [7]. We aimed to investigate whether patients who underwent surgery for acute type A aortic dissection at night time, suffered worse immediate and long term outcomes than those who underwent surgery during working hours at Castle Hill Hospital.

Methods

Using our cardiothoracic data base and electronic patient records we performed a retrospective analysis of all acute type A aortic dissection surgery performed at Castle Hill Hospital between 2008 to 2018. A univariate analysis of pre, intra and post- operative factors were considered. MedCalc© software was used for statistical analysis. P values were obtained using T-Test, Mann-Whitney Test and Chi Squared Test depending on the numerical data sequence analyzed. Only patients who were taken to theatre were considered for this study, excluding those where treatment was palliative at the time of presentation. The start of the operation (time of first incision) dictated which category the patient was grouped. Scan to Theatre Time (STT) was calculated based upon the time of the diagnostic CT report subtracted from the start of the surgery. Day time was defined as between 0800-1959; night time was defined as 2000 to 0759; based upon the working hours of the on-call surgical team. A Kaplan-Meier curve was plotted to compare long-term survivability.

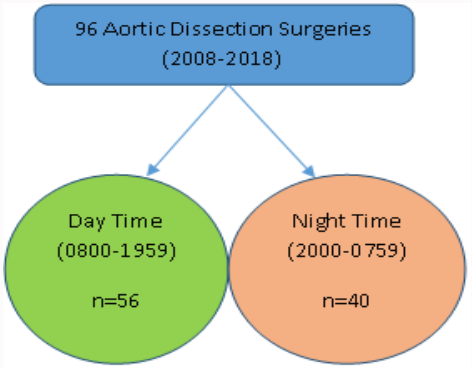

Figure 1: Number of Aortic Dissection Surgeries at Castle Hill Hospital 2008 to 2018.

Variable	Cases repaired within working Hours (n=56)	Cases repaired outside of working hours (n=40)	P Value
Pre-Operative Factors			
Age (Mean)	62	61	0.27
Male Gender (%)	40 (71.4)	28 (70)	0.88
Average Scan to theatre time (Hours)	104	5	<0.01
IV Inotropes (%)	3 (5.4)	5 (12.5)	0.21
IV Nitrates (%)	10 (17.9)	6 (15)	0.7
Surgery < 24hrs of Admission (%)	17 (30.4)	28 (70)	<0.01
Intra-Operative Details			
(1) Interposition +/- Aoritc Valve	28	18	0.23
(2) Aortic Root +/- (1)	10	12	
(3) Hemi-arch +/- (1,2)	9	8	
(4) Arch +/- (1,2,3)	9	2	
Mean Duration of Surgery(Minutes)	410	412	0.45
Post-Operative Events			
Median Time on ICU (Hours)	128	78	0.1
Re-open for bleeding/tamponade (%)	8 (14.3)	4(10)	0.5
Stroke (%)	6 (10.7)	3 (7.5)	0.59
New Haemofiltration (%)	9 (16)	7 (17.5)	0.85
Multisystem Failure (%)	4(14.3)	5 (12.5)	0.8
In Hospital Mortality (%)	11 (19.6)	14 (35)	0.09

Figure 2: Comparison of Pre, Intra and Post-Operative Variables.

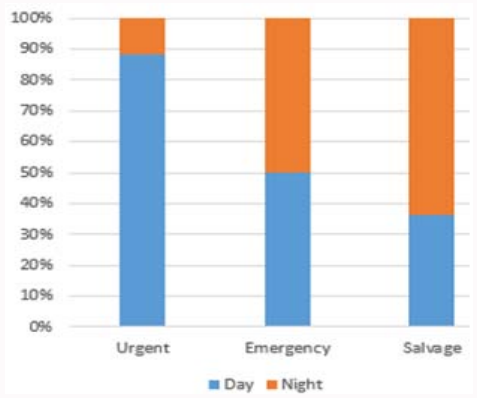

Figure 3: Operative Category Comparison between Day and Night Surgeries P <0.05.

Results

Between 2008 to 2018 (at the time of analysis) a total of 96 operations were performed for type A aortic dissection at Castle Hill Hospital. 56 were performed during the day and 40 at night time. There was a significant difference in mean STT between day and night surgeries, 104 h *vs.* 5 h respectively. There was no significant difference in pre-op haemodynamic status between the two groups-when considering the need for inotropic support. A much greater percentage of night time cases were repaired within 24 h of admission, suggesting this group of patients had a comparatively worse life-threatening presentation. This is also reflected when appreciating the proportion of operative urgency between the two groups. The type of surgery between day and night was proportionally similar regarding the extent of dissection repair showing no statistically significant difference in operative method. Post-operative events between the two groups showed no significant difference including; ICU time, bleeding/tamponade, stroke, hemofiltration, multisystem failure and in hospital mortality. The most notable difference regarding long term mortality was 4 to 7 years after surgery. At 6 years patients who underwent surgery at night time had half the survival probability compared to day time cases (20% *vs.* 40%). However we notice that the trend becomes similar from 7 years and beyond.

Discussion

Scan to theatre time & operative urgency

Most interestingly, night time cases had a much shorter scan to theatre time and the majority of these cases were taken to theatre within 24 h of their admission. When coupling this with the fact that most of the highest risk patients (salvage cases) were operated at night time, we can infer that night time patients were less clinically stable, in need of immediate surgery and therefore likely to have a worse outcome compared with patients who underwent surgery within working hours. Although there was no statistically significant difference in the need for inotropic support, a doubling of percentage of night time cases requiring IV inotropes (12.5% *vs.* 5.4%) cannot be ignored, further implying a clinically poorer patient cohort. Our data also implies that our unit prefers the practice of undertaking acute dissection surgery in the day time, as the average STT of these cases was 104 h, and only 30.4% of day time surgeries were performed within 24 h of admission. This implies that in cases where patients are relatively clinically stable, surgery is halted until a complete multidisciplinary assessment is conducted and initial medical treatment is initiated. Surgical treatment is commenced during the day time where the unit is more appropriately staffed with a well-rested, alert surgical team. These results brings into question the traditional perspective of immediate surgery for all acute dissections, as we demonstrate reduction in hospital mortality and enhanced long term survivability for day time cases, even though surgery was delayed.

Patient outcomes & mortality

Overall no significant difference was observed with regards to post-operative complications between the two groups. We can infer that the decision to undertake surgery out of hours did not impact immediate patient outcomes. Furthermore this would imply a consistency in clinical approach and patient care regardless to timing of surgery. Although there was no statistically significant difference in the in hospital mortality, a 15% increase in night time surgeries may be seen as clinically notable. This would be expected considering that, as discussed, night time cases were likely presenting with a more acutely dangerous clinical picture. Most interestingly the day time cases had a much higher survival probability between 4 to 7 years. The trends run parallel before and after this point making a correlation to time of surgery difficult to justify. A worse long term prognosis could

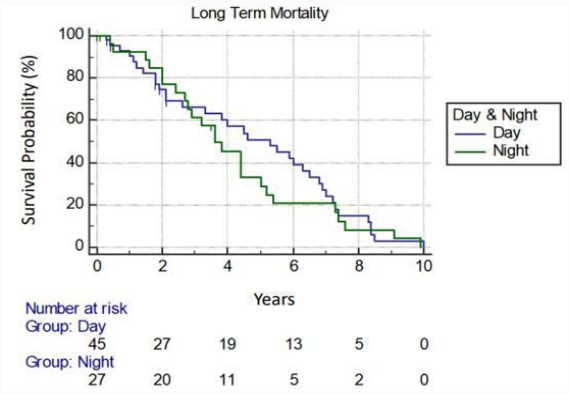

Figure 4: Kaplan-Meier Curve representing survivability between night time and day time operations.

again be explained by the observation that sicker patients had to be operated on at night time, as opposed to the timing of the surgery itself or the human factors that may have influenced the procedure.

Limitations

Acute type A aortic dissection is a relatively rare pathology affecting between 3-9 persons per 100,000 in the population [8]. As a consequence any single unit, unless highly specialised to deal with vast numbers of aortic cases, will only occasionally come into contact with this condition. Hence our analysis of only 96 patients may not be sufficient to conclude upon the research question one way or the other and a larger scale, multi-centre study is recommended. Patient co-morbidities and presenting complications also play an important role in predicting morbidity and mortality following dissection repair [1]. Appreciating these influences is beyond the scope of this study. A group-matched analysis to exclude potential confounding variables may provide a clearer insight into the effect of timing on patient outcome. None-the-less, the impact of human factors in clinical practice, such as sleep deprivation, is important to consider when undertaking risky procedures. Our study implies a preference to carry out this surgery within working hours, a school of thought adopted by other surgical disciples, challenging the traditional perception of immediate surgery for all patients presenting with acute type A aortic dissection. The decision to embark upon the procedure remains a clinical one, at the prerogative of the on-call consultant surgeon and multi-disciplinary team.

Conclusion

Our study did not demonstrate a statistically significant difference in the immediate and long term patient outcomes of those undergoing surgery for acute type A aortic dissection at night time compared with the day.

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