



Volume-outcome relationship in type A aortic dissection: crosswords or crossroads?

Lara Rimmer¹, Hazem Elsantawy¹, Amer Harky², Mohamad Bashir¹

¹Vascular Surgery Department, Royal Blackburn Teaching Hospital, Blackburn, UK; ²Cardiothoracic Surgery Department, Liverpool Heart and Chest Hospital, Liverpool, UK

Correspondence to: Mohamad Bashir, MD, PhD, MRCS. Vascular Surgery Department, Royal Blackburn Teaching Hospital, Haslingden Road, BB23HH, UK. Email: drmbashir@mail.com.

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We commend Nguyen and colleagues who published an article entitled, ‘*Acute Type A Dissection (ATAAD) Repair by High versus Low Volume Surgeons at a High-Volume Aortic Center* (1).’ At their institution, they reviewed two surgeons with an extremely high caseload of ATAAD >10 per year “HVAS”, versus 5 surgeons with a caseload of ≤10 per year “LVAS”. They categorized each operation into pairings of primary surgeon and first assistant, resulting in four classes: HVAS-HVAS, HVAS-LVAS, LVAS-HVAS, LVAS-LVAS. They presented an increased mortality in the LVAS-LVAS group, and an odds ratio of 3.9 (P<0.01) in the early mortality group.

Nguyen *et al.* postulated further that it is the high volume of numbers and expertise achieved by the two surgeons which produce better outcomes than those performing less. This finding has been noted by one of our studies on similar entity utilizing national data among others (2-4). However, more debated is whether high volume institutions are also associated with improved outcomes, compared to centres who perform less; the theory being that high volume centres are better equipped with teams and procedures, or whether it is the surgeon alone that influences the outcome. Nguyen’s study postulated that by assessing the team at Houston—a well-equipped, ‘high volume’ centre, removed the bias of having differing institutions influencing surgical outcomes. It is interesting therefore to note that even in a high-volume institution, the differences Nguyen *et al.* found

between HVAS and LVAS is significant. Even long-term mortality was increased in the LVAS-LVAS group, implying that even once out of hospital the patients are not out of the woods.

If volume is indeed of such high importance that LVAS-LVAS led teams are having significantly worse outcomes, then as a patient safety issue it stands to reason that teams should require at least one HVAS, or a surgeon who had reached a minimum volume of surgeries (5,6). In other areas, this quota-based surgical volume may not ensure optimal quality of treatment and exclude lower volume centres or surgeons with good outcomes (7).

Further work in determining a “minimum standard” of volume would have to be evident. In Nguyen *et al.*’s case, their HVAS had an “unusually high” volume per year, perhaps unrealistic to expect of all others to achieve, and not representative of a standard cohort. As to the hospitals, centralising care into only high-volume hospitals may imbalance health inequalities for those living further from main cities or in rural areas.

In a study by Brat *et al.*, they reported on 30 elective aortic arch surgeries in a low-volume hospital over 13 years and concluded their mid-term results were at an acceptable level (8). Volume-based surgery would penalise these centres.

It is important to note, however, some of the other results Nguyen found. Whilst they quote long-term

survival Kaplan-Meier outcomes over 5 years with LVAS-LVAS being the worst, the best predicted overall survival was in the LVAS-HVAS group and, closely, HVAS-LVAS. Rather than the volume surgeries—in which the predicted mortality would have HVAS-HVAS as optimal—could this be representing something else, a non-technical surgical skill seen in the mixed teams? Interpersonal surgical skills and leadership is a key factor in performance (9). In one qualitative study, the importance of delegation, guidance of team (10), reassurance and encouragement all contributed to positive undercurrents in theatre (9). Therefore, the dynamic between first surgeon and assistant could be hugely important and would vary between hospitals as well as individually.

A systematic review on non-technical skills suggested factors of feedback, stress, fatigue and communication all may play an important role, and may explain why the mixed teams did well by having a more experienced surgeon present (10). In a qualitative study interviewing surgeons about their opinions on volume-outcome surgery, some of the answers suggested that repetitive experience may allow the surgeon to become quicker, but not necessarily improve outcomes (11). Nguyen's study did appear to suggest this, with statistically shorter cardiopulmonary bypass times, cross-clamp and circulatory arrest times in groups without a HVAS (1). Surgeons then reported on having the greater experience through volume to make difficult decisions, interlinking both volume and non-technical skills as factors to success (11).

Practical questions arise from Nguyen's methods; for surgeons performing low volumes of ATAAD, what did they do otherwise? There is no mention of grade or experience bar some descriptive lines. It is unclear what was classified as 'previous experience' of ATAAD, of which one HVAS had "significant experience". No LVAS performed more than 10 ATAAD per year, but it would be interesting to see what the spread of procedures performed through the 5 LVAS were. In this study, the groups were split into hard groups, of which >10 procedures were taken as a hard line for high volume. As stated by the authors, >10 procedures were unusually high across studies; this could have been a prime opportunity to split the groups into three, demonstrating the impact of having low, medium and high-volume surgeons performing the same procedures. Results for early mortality are fear-inducing; Nguyen *et al.* presented this initially as unadjusted in-hospital mortality rates, before adjusting for significant preoperative factors and calculating an odds ratio in the LVAS-LVAS group of 3.9 ($P < 0.01$).

They described this as nearly a "four-fold" increase. As odds ratio is a comparison of two factors, it is unclear what group was used as a comparison for this but does not seem to reflect the heterogeneity of the groups within the study.

Overall, Nguyen's paper is a topical and pressing one, adding yet more to the evidence base that higher volume of surgeries performed has a better outcome for patients both on the operating table and long-term. In an age where cardiothoracic surgical procedures are becoming more focused, surgical training must adapt to ensure all trainees have exposure to a volume of procedures. Development of simulation has proved successful recently, and may provide some solution to volume and procedural confidence (12,13).

It is likely that both volume and hospital environment both have an impact on outcome, but by introducing minimum-volume requirements may simplify a complex issue of non-technical factors and experience we do not fully understand.

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Footnote

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