

## AORTIC STENOSIS – TRUTHS AND MYTHS

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This talk reviews the preoperative risk stratification of patients diagnosed with aortic stenosis (AS) who are scheduled for non cardiac surgery. Understanding risk in these patients is important as it serves to guide decisions made by the clinician and the patient around the advisability of an operation.

The first study to discuss AS as a risk factor in non cardiac surgery was published in 1964.<sup>1</sup> A 10% mortality rate was described. In the intervening years little has changed with the 2009 updated ACC/AHA guidelines stating “severe AS poses the greatest risk for non cardiac surgery” with a “mortality risk of approximately 10%.”<sup>2</sup> Studies referenced in the guidelines are shown in Table 1.

Table 1 – AS and Risk in Non Cardiac Surgery – ACC/AHA Guidelines 2009

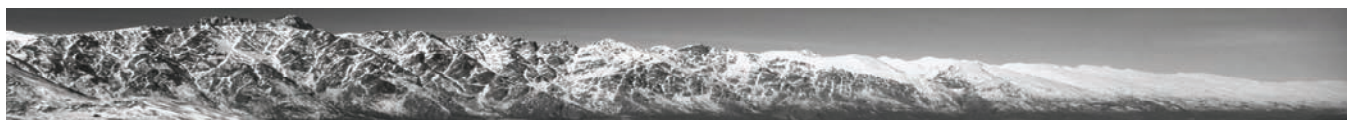
Study	Numbers	Study Type	Comment	Outcome
Goldman <sup>3</sup>	23	Prospective case controlled	Clinical diagnosis of AS only. No stratification between asymptomatic and symptomatic patients	Goldman's Cardiac Risk Index – AS ranked 6th behind CCF, MI, PVC's, >70yrs, emergency
Raymer <sup>4</sup>	55	Retrospective case controlled	Mix of moderate and severe AS	10% mortality in the AS and control group
Torsher <sup>5</sup>	19	Case series	16 cases symptomatic	Two deaths 1. Elective bilateral TKJR 2. Emergency laparotomy
Zahid <sup>6</sup>	5149	Retrospective case controlled	Unable to grade severity of AS or stratify for symptoms	No difference in mortality. Increased risk of AMI but only for low and intermediate risk surgery

In the same year European guidelines were produced which concluded “severe AS constitutes a well-established risk factor for perioperative MI and mortality.”<sup>7</sup> The only new work referenced was a paper by Kertai in 2004.<sup>8</sup> The results from this paper are shown in Table 2.

Table 2 – Aortic Stenosis and Cardiac Risk Factors (Kertai)<sup>8</sup>

Revised Cardiac Index Score	Cardiac Events in Controls	Cardiac Events in Patients with AS
0	0%	0%
1	3%	10%
2	3%	16%
≥3	6%	29%

AS in isolation had the same outcome as controls but increasing risk with RCRI suggests the risk with AS is not only dependent on severity and symptoms but on the interaction with other known risk factors. A detailed



examination of the remaining literature reveals further conflicting evidence and no clearer risk profile. A summary of this evidence is presented in Table 3.

Table 3 – Perioperative Risk Associated with AS in Non Cardiac Surgery

Study	Numbers	Study Type	Comments	Outcome
Agarwal <sup>9</sup>	634	Retrospective case controlled	In patients with severe AS the only significant single complication was AMI – 71% in this group had coronary heart disease. In those with severe AS but without AMI only 40% had coronary heart disease  Other variables measured – 30 day mortality, CCF, stroke were no different to controls	Primary outcome = 30 day mortality + AMI  Significant factors – <ul style="list-style-type: none"> <li>▪ High risk surgery (OR = 7.3)</li> <li>▪ MR (OR = 9.8)</li> <li>▪ Symptomatic severe AS (OR = 2.7)</li> <li>▪ Coronary heart disease (OR = 2.7)</li> </ul>
Calleja <sup>10</sup>	30 with severe AS	Retrospective case controlled	Compared outcome between asymptomatic moderate and severe AS > 75yrs undergoing non cardiac surgery	No increased AMI or death in patients with severe AS
O’Keefe <sup>11</sup>	48	Retrospective case series	75% symptomatic CCF 19% angina 7% syncope	No deaths but 7 (14%) perioperative events reported
McBrien <sup>12</sup>	94	Retrospective case controlled	Mortality in hip fracture patients undergoing surgery	No increased risk of death with AS  Sig difference in anaesthetic
Liebwitz <sup>13</sup>	32	Retrospective case controlled	Patients undergoing surgery for hip fracture	No increased risk for cardiac events or death with AS
Adunsky <sup>14</sup>	62	Retrospective case controlled	Patients admitted to hospital with hip fracture  19% were symptomatic	AS patients had surgical and non surgical treatments  6 AS patients treated non surgically. Two of these died  56 AS patients operated on. Two died. Mortality = 3.6%  Non AS operated patients 94. Mortality = 3.3%

When trying to establish the risk associated with AS (or assessing the available evidence) what other factors do we need to take into account outside the evidence presented above. The natural history of AS alerts us to the fact once symptomatic patients cross into a higher risk group. It would seem sensible to translate this higher risk into the operative setting.

Presenting symptom	Mortality without AVR
Angina	50% die within 5 years
Syncope	50% die within 3 years
Dyspnoea	50% die within 2 years

Even if asymptomatic some patients are at increased risk with a small percentage of patients (approx. 4%) having a significant cardiac event / death or a rapid rate of progression to the symptomatic state requiring urgent AVR.<sup>15,16,17</sup> Potential predictors of outcome in this group have been identified as – <sup>15,16,18,19,20 21,22,23,24,25,26</sup>

- Coronary artery disease
- Functional status



- Exercise testing
- Severity of AS
- Aortic valve calcification
- Reduced left ventricular ejection fraction (LVEF)
- BNP/NT- BNP

Should patients undergo AVR, outcome is generally good with a mortality of around 2%. This applies to the “classic” AS patient with a good cardiac output and high flows across the valve producing high velocities. Some patients despite having severe stenosis determined by valve area have low gradients/velocities across the valve secondary to a low cardiac output.<sup>20,25,26,27,28</sup> This group are classified as paradoxical low flow (PLF) and are mostly associated with a reduced LVEF. Stress echocardiography reveals subsets of aortic stenosis according to the effect of the dobutamine on LV contractility.<sup>27,28</sup>

- Reduced LVEF but contractility reserve (CR) intact-dobutamine produces an increase in LVEF 20% and an increase in the mean aortic pressure gradient.
- Reduced LVEF no contractility reserve-dobutamine fails to produce an increase in LVEF or the mean aortic pressure gradient.
- Pseudo-severe AS – dobutamine produces an improvement in LV function increasing the mean gradient but also increasing the aortic valve area to a value  $> 1.0\text{cm}^2$ .

Collective perioperative mortality for patients with PLF is around 15%.<sup>16,17</sup> In patients with preserved LV contractility reserve this reduces to 5%. In contrast, if contractility reserve is absent perioperative mortality can be as high as 30%. PLF is also seen in patients with a preserved LVEF. These patients have impaired LV relaxation, reduced stroke volume and reduced cardiac output suggesting significant impairment in intrinsic myocardial function. This “diastolic failure group” also do worse following AVR.<sup>29,30</sup>

### So what to do on Monday?

- Clearly define the “type” of AS. Is it high or low flow? If low flow consider systolic function / contractility reserve / pseudo-severe AS / diastolic function.
- Further determine cardiac status with BNP / NT-BNP
- Identify significant other cardiac pathology eg MR / RVSP
- “Characterise” the risk by evaluating the clinical picture – symptoms / NYHA / CCSAG / Lee Revised Cardiac Risk Index / function status / frailty.
- Adjust risk according to general risk factors for non cardiac surgery
- Add patient to AS database [www.asdb.ac.nz](http://www.asdb.ac.nz)!
- Calculate AortoScore – coming soon!

### Summary

It seems severe AS is likely to increase operative risk, but questions remain as to how much and in what circumstances. The natural history of AS and the outcome data following AVR would suggest variable risk in this population based on symptoms, clinical factors, detailed echocardiographic and cardiac assessments. What translates from predictors of outcome in other fields of medicine to risk in non cardiac surgery has yet to be confirmed.

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