Is ministernotomy superior to conventional approach for aortic valve replacement?

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Summary

A best evidence topic in cardiac surgery was written according to a structured protocol. The question addressed was: is ministernotomy superior to conventional approach for aortic valve replacement (AVR)? Altogether, more than 115 papers were found using the reported search, of which six represented the best evidence to answer the clinical question. The authors, journal, date and country of publication, patient group studied, study type, relevant outcomes and results of these papers are tabulated. We conclude that ministernotomy can be performed safely for AVR, without increased risk of death or other major complication; however, few objective advantages have been shown. Ministernotomy can be offered on the basis of patient choice and cosmesis rather than evident clinical benefit.

Keywords: Ministernotomy; Minimally invasive; Aortic valve replacement; Humans

1. Introduction

A best evidence topic was constructed according to a structured protocol. This is fully described in the ICVTS [1].

2. Three-part question

In [patients undergoing an aortic valve replacement] is [a ministernotomy] superior [to conventional approach].

3. Clinical scenario

You are at a national conference hearing about the benefits of a ministernotomy approach for aortic valve replacement (AVR). An eminent speaker from the floor then stands up and contends that there have been no definitively proven benefits over the median sternotomy. He continues saying that the implantation time is significantly higher with associated increased morbidity. You resolve to check the literature yourself.

4. Search strategy

[aortic valve replacement OR exp aortic valve OR review OR ministernotomy OR minimally invasive AND aortic valve replacement OR AVR AND humans].

5. Search outcome

One hundred and fifteen papers were found using the reported search. From these, six papers were identified, that provided the best evidence to answer the question. These are presented in Table 1.

6. Results

Brown et al. [2] in 2009 performed a meta-analysis of 26 trials for a total of 4586 patients who underwent isolated AVR. They divided them into two groups: 2054 ministernotomy and 2532 full sternotomy. They found that there was no difference in mortality but the ministernotomy group had a longer cross-clamp and bypass time. In addition, they showed that ITU and hospital stay, ventilation time and blood loss were less in the ministernotomy group. Nevertheless few objective advantages have been demonstrated.

Murtuza et al. [3] in 2008 performed a meta-analysis of the published trials including 4667 patients. They showed marginal benefits in perioperative mortality (4667 patients; odds ratio, 0.72; 95% confidence interval (CI), 0.51–1.00; \( P = 0.05 \)), intensive care unit (ICU) stay, total hospital stay, and ventilation time in the minimal access AVR group, although cross-clamp, cardiopulmonary bypass, and total operation times were longer. Study heterogeneity and apparent benefits in perioperative mortality were related to study quality, although results for ICU and hospital stay were maintained according to the sensitivity analysis. This suggests that minimal access AVR can be offered on the basis of patient choice and cosmesis rather than evident clinical benefit.

Bakir et al. [4] in 2007 conducted a retrospective analysis including 506 patients split into two groups: 232 ministernotomy and 274 median sternotomy. The minimal access group had reduced aortic cross-clamp and cardiopulmonary...
Table 1
Best evidence papers

<table>
<thead>
<tr>
<th>Author, date and country, Study type (level of evidence)</th>
<th>Patient group</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown et al., (2009) J Thorac Cardiovasc Surg, USA, [2]</td>
<td>Twenty-six studies were selected, with 4586 patients with AVR (2054 ministernotomy, 2532 full sternotomy)</td>
<td>Mortality</td>
<td>There was no difference in mortality (odds ratio 0.71, 95% CI 0.49–1.02)</td>
<td>Ministernotomy can be performed safely for AVR, without increased risk of death or other major complication; however, few objective advantages have been shown</td>
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<tr>
<td>Meta analysis (level 1a)</td>
<td></td>
<td>Cross-clamp and bypass time</td>
<td>Ministernotomy had longer cross-clamp and bypass times (weighted mean difference 7.90 min, 95% CI 3.50–10.29 min, and 11.46 min, 95% CI 5.26–17.65 min, respectively)</td>
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<td>ITU and hospital stays</td>
<td>Both stays were shorter with ministernotomy (weighted mean difference –0.46 days, 95% CI –0.72 to –0.20 days, and –0.91 days, 95% CI –1.45 to –0.37 days, respectively)</td>
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<td>Ventilation time and blood loss</td>
<td>Ministernotomy had shorter ventilation time and less blood loss within 24 h (weighted mean difference –2.1 h, 95% CI –2.95 to –1.30 h, and –79 ml, 95% CI –23 to 136 ml, respectively)</td>
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</tr>
<tr>
<td>Murtuza et al., (2008) Ann Thorac Surg, UK, [3]</td>
<td>4667 patients</td>
<td></td>
<td></td>
<td>Marginal benefits in peri-operative mortality (4667 patients; odds ratio, 0.72; 95% CI, 0.51–1.00; P=0.05), ICU stay, total hospital stay, and ventilation time in the minimal access AVR group, although cross-clamp, cardiopulmonary bypass, and total operation times were longer</td>
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<td>Bakir et al., (2007) Ann Thorac Surg, Turkey, [4]</td>
<td>506 patients: 232 ministernotomy, 274 median sternotomy</td>
<td>Mortality</td>
<td>Early mortality was 2.6% (6 patients) in ministernotomy group and 4.4% (12 patients) in median sternotomy group</td>
<td>AVR can be performed safely through a partial upper sternotomy on a routine basis for isolated aortic valve disease</td>
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<tr>
<td>Retrospective study (level 3)</td>
<td></td>
<td>Cross-clamp and bypass time</td>
<td>The minimal access group had reduced aortic cross-clamp and cardiopulmonary bypass times compared with conventional group: 61.8 ± 16.6 vs. 69.5 ± 16.6 min (P&lt;0.05) and 88.8 ± 23.2 vs. 100.2 ± 22.6 min (P&lt;0.05), respectively</td>
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<tr>
<td></td>
<td></td>
<td>Mean blood loss</td>
<td>Mean blood loss was lower in group 1 compared with group 2 (P&lt;0.05)</td>
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<td></td>
<td>ITU and hospital stays</td>
<td>ICU and hospital stays were shorter in the minimal access group: 2.1 ± 2.5 vs. 2.5 ± 5.3 days (P=non-significant) and 10.8 ± 7.1 vs. 12.8 ± 10.6 days (P&lt;0.05), respectively</td>
<td></td>
</tr>
<tr>
<td>Sharony et al., (2004) J Heart Valve Dis, USA, [5]</td>
<td>921 consecutive patients underwent isolated AVR; 438 of these had minimally invasive AVR (MIAVR)</td>
<td>Mortality and morbidity</td>
<td>Hospital mortality and major morbidity were similar in the MIAVR and SS groups: 5.6% vs. 7.3% (P=0.45) and</td>
<td>MIAVR can be performed safely, with morbidity and mortality outcomes similar to those of standard</td>
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bypass times compared with conventional group: 61.8 ± 16.6 vs. 69.5 ± 16.6 min (P<0.05) and 88.8 ± 23.2 vs. 100.2 ± 22.6 min (P<0.05), respectively. Mean blood loss was lower in the ministernotomy group compared with median sternotomy (P<0.05). ICU and hospital stays were shorter in the minimal access group: 2.1 ± 2.5 vs. 2.5 ± 5.3 days (P=non-significant) and 10.8 ± 7.1 vs. 12.8 ± 10.6 days (P<0.05), respectively. This is the only article found in the medical literature, which shows a shorter cross-clamp time and bypass time compared to the conventional approach.

Sharony et al. [5] in 2004 retrospectively reviewed 921 patients who underwent isolated AVR, 438 of those had ministernotomy access. Hospital mortality and major morbidity were similar in both groups: 5.6% vs. 7.3% (P=0.45) and 13.3% vs. 14.2% (P=0.79), respectively. Multivariable analysis of all patients revealed increased mortality with severe atheromatous aortic disease (P=0.001), COPD (P=0.002), and urgent operation (P=0.02). Freedom from any major peri-operative morbidity was similar in both groups (86.7% vs. 85.8%; P=0.79). However, the median length of stay was shorter with ministernotomy group (6 vs. 8 days; P<0.001). During the past 3 years, a greater percentage of minimally invasive patients than full sternotomy patients was discharged home rather than sent to rehabilitation facilities or nursing homes (65.7% vs. 52.9%; P=0.05).

Mihaljevic et al. [6] in 2004 reviewed retrospectively 526 patients. They showed that operative mortality was 12/526 (2%) in the AV. Freedom from re-operation at 6 years was 99% and late mortality was 5%.

Masiello et al. [7] in 2002 analyzed retrospectively 200 patients of whom 100 received ministernotomy approach. Operating times were significantly longer in the ministernotomy group (P<0.001). Mechanical ventilation time, ICU and total hospital stay, and total postoperative bleeding showed no significant difference. Adjunctive statistical evidenced the absence of learning curve. Mortality and other complications failed to reveal any significant difference between the two groups.

7. Clinical bottom line

We conclude that ministernotomy can be performed safely for AVR, without increased risk of death or other major complication; however, few objective advantages have
been shown. Ministernotomy can be offered on the basis of patient choice and cosmesis rather than evident clinical benefit.

References


