Prognostic blood biomarkers in shoulder surgery

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Fellow Researchers

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Ethics Approval

- Curtin University Human Research Ethics Committee
- Bethesda Hospital Medical Advisory Committee
Shoulder Pain

• Shoulder pain and dysfunction is common
• Significant burden to patient, society and healthcare system\(^1\)
• Frequently attributed to rotator cuff disease or ‘impingement’
• Prevalence increases with age\(^2\)
KEEP CALM AND LOVE ARNIE
Rotator Cuff Disease (RCD)

- Exact aetiopathogenesis unknown; likely multifactorial
- Intrinsic\textsuperscript{3,4} v Extrinsic model\textsuperscript{5}
Rotator Cuff Disease (RCD)

• Conservative v Surgical management
• Much debate over the efficacy of surgery in RCD\textsuperscript{6,7}
• Treatment for should be individualised
• How do we decide which patient with RCD will have a better outcome from surgery?
• Cochrane review 2008 - We need a better understanding of aetiopathogenesis and prognostic factors\textsuperscript{8}
Tendon Disease

- Failed healing response is a hallmark of tendinopathy\textsuperscript{9}
- Well demonstrated link between these markers and lower limb tendinopathy\textsuperscript{10}
- Emerging evidence of adiposity and poor glycaemic control as a risk factor for RCD\textsuperscript{11-15}
- Diabetics have poorer outcomes following shoulder surgery\textsuperscript{16,17}
- These tendon risk factors could affect healing and outcomes of surgery for rotator cuff disease
Do serum markers of adiposity and glycaemic control have a prognostic effect on surgical outcomes in RCD?
Methodology

- Prospective cohort study
- 53 patients recruited over 6 months
- 6 Orthopaedic surgeons involved at Bethesda Hospital
- 12 month follow-up
Pre-operative Measures

- Demographics - age, gender, BMI, smoking status, occupational tasks, duration of symptoms
- Intra-operative
  - Subacromial decompression +/- rotator cuff repair
  - Arthroscopic, mini-open or open
- Disability of the Arm, Shoulder and Hand (DASH) questionnaire
- Fasting blood test
  - Lipid profile (total chol, LDL, HDL, Tg)
  - Apolipoprotein A & B
  - Glucose
  - HbA1c
  - Insulin
Outcome Measures

- DASH questionnaire
  - 30 item, self-report questionnaire
  - Validated & reliable
  - Score 0-100
- Ultrasound examination
  - Senior MSK Radiologist
  - Tendon quality & integrity
# Disabilities of the Arm, Shoulder and Hand

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

<table>
<thead>
<tr>
<th>NO DIFFICULTY</th>
<th>MILD DIFFICULTY</th>
<th>MODERATE DIFFICULTY</th>
<th>SEVERE DIFFICULTY</th>
<th>UNABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

1. Open a tight or new jar.
2. Write.
3. Turn a key.
4. Prepare a meal.
5. Push open a heavy door.
6. Place an object on a shelf above your head.
7. Do heavy household chores (e.g., wash walls, wash floors).
8. Garden or do yard work.
9. Make a bed.
10. Carry a shopping bag or briefcase.
11. Carry a heavy object (over 10 lbs).
12. Change a light bulb overhead.
13. Wash or blow dry your hair.
14. Wash your back.
15. Put on a pullover sweater.
16. Use a knife to cut food.
17. Recreational activities which require little effort (e.g., card playing, knitting, etc.).
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).
19. Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).
20. Manage transportation needs (getting from one place to another).
21. Sexual activities.

## Disabilities of the Arm, Shoulder and Hand

<table>
<thead>
<tr>
<th>NOT AT ALL</th>
<th>SLIGHTLY</th>
<th>MODERATELY</th>
<th>QUITE A BIT</th>
<th>EXTREMELY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

22. During the past week, to what extent has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or group? (circle number)

<table>
<thead>
<tr>
<th>NOT LIMITED AT ALL</th>
<th>SLIGHTLY LIMITED</th>
<th>MODERATELY LIMITED</th>
<th>VERY LIMITED</th>
<th>UNABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem? (circle number)

Please rate the severity of the following symptoms in the last week. (circle number)

<table>
<thead>
<tr>
<th>NO</th>
<th>MILD</th>
<th>MODERATE</th>
<th>SEVERE</th>
<th>EXTREME</th>
</tr>
</thead>
</table>

24. Arm, shoulder or hand pain.
25. Arm, shoulder or hand pain when you performed any specific activity.
26. Tingling (pins and needles) in your arm, shoulder or hand.
27. Weakness in your arm, shoulder or hand.
28. Stiffness in your arm, shoulder or hand.

<table>
<thead>
<tr>
<th>NO DIFFICULTY</th>
<th>MILD DIFFICULTY</th>
<th>MODERATE DIFFICULTY</th>
<th>SEVERE DIFFICULTY</th>
<th>SO MUCH DIFFICULTY CAN’T SLEEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? (circle number)

<table>
<thead>
<tr>
<th>STRONGLY DISAGREE</th>
<th>DISAGREE</th>
<th>NEITHER AGREE</th>
<th>AGREE</th>
<th>STRONGLY AGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</tr>
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</table>

30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem. (circle number)

DASH DISABILITY/SYMPTOM SCORE = [(sum of n responses) - 1] x 25, where n is equal to the number of completed responses.

A DASH score may not be calculated if there are greater than 3 missing items.
Study Cohort

- 48 patients (90.6%) completed follow-up DASH questionnaire
- 30 male, 18 female
- Mean age = 55 (31 - 78)
- 7 smokers, 41 non-smokers

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthroscopic acromioplasty only</td>
<td>22</td>
</tr>
<tr>
<td>plus arthroscopic rotator cuff repair</td>
<td>14</td>
</tr>
<tr>
<td>plus mini-open rotator cuff repair</td>
<td>7</td>
</tr>
<tr>
<td>plus open rotator cuff repair</td>
<td>5</td>
</tr>
</tbody>
</table>
Results

- Demographic factors did not correlate with outcome

- Baseline DASH mean = 38/100 (5 - 81.25)
- Post-operative DASH mean = 9.18/100 (0-40.83)

- Baseline DASH score predicted for outcome
  - Beta coefficient 0.66 (95% CI 0.16 - 1.16, \( P = 0.011 \))
  - A high pre-operative score was more likely to result in a high post-operative score
Correlation between pre-operative serum markers and post-operative DASH score

<table>
<thead>
<tr>
<th>Predictor variable</th>
<th>Beta Coefficient</th>
<th>95% CI</th>
<th>P-value</th>
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<tbody>
<tr>
<td>Total Cholesterol</td>
<td>0.07</td>
<td>-0.22 - 0.37</td>
<td>0.620</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>0.28</td>
<td>-0.25 - 0.82</td>
<td>0.295</td>
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<tr>
<td>LDL Cholesterol</td>
<td>0.03</td>
<td>-0.32 - 0.38</td>
<td>0.849</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>-0.07</td>
<td>-0.81 - 0.67</td>
<td>0.852</td>
</tr>
<tr>
<td>Cardiac Risk Ratio</td>
<td>0.13</td>
<td>-0.13 - 0.38</td>
<td>0.330</td>
</tr>
<tr>
<td>Apolipoprotein A</td>
<td>0.18</td>
<td>-0.70 - 1.07</td>
<td>0.681</td>
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<td>Apolipoprotein B</td>
<td>0.29</td>
<td>-0.88 - 1.46</td>
<td>0.619</td>
</tr>
<tr>
<td>Glucose</td>
<td>0.05</td>
<td>-0.07 - 0.16</td>
<td>0.404</td>
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<tr>
<td>Insulin</td>
<td>0.52</td>
<td>0.03 - 1.01</td>
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</tr>
<tr>
<td>Glycated Haemoglobin</td>
<td>0.10</td>
<td>0.00 - 0.20</td>
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<td>0.00 - 0.20</td>
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</table>
Correlation between pre-operative serum markers and post-operative DASH score (adjusted for baseline DASH)

<table>
<thead>
<tr>
<th>Predictor variable</th>
<th>Beta Coefficient</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>0.03</td>
<td>-0.25 - 0.32</td>
<td>0.805</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>0.09</td>
<td>-0.45 - 0.62</td>
<td>0.750</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>0.00</td>
<td>-0.33 - 0.34</td>
<td>0.979</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>0.10</td>
<td>-0.61 - 0.81</td>
<td>0.787</td>
</tr>
<tr>
<td>Cardiac Risk Ratio</td>
<td>0.03</td>
<td>-0.23 - 0.29</td>
<td>0.818</td>
</tr>
<tr>
<td>Apolipoprotein A</td>
<td>0.30</td>
<td>-0.54 - 1.15</td>
<td>0.477</td>
</tr>
<tr>
<td>Apolipoprotein B</td>
<td>0.08</td>
<td>-1.05 - 1.21</td>
<td>0.889</td>
</tr>
<tr>
<td>Glucose</td>
<td>0.02</td>
<td>-0.09 - 0.17</td>
<td>0.670</td>
</tr>
<tr>
<td>Insulin</td>
<td>0.32</td>
<td>-0.19 - 0.84</td>
<td>0.213</td>
</tr>
<tr>
<td>Glycated Haemoglobin</td>
<td>0.04</td>
<td>-0.07 - 0.16</td>
<td>0.456</td>
</tr>
</tbody>
</table>
Results

• No correlation between serum markers and outcomes of pain and function following surgery for RCD

• Patients with higher serum insulin and glycated haemoglobin had more pain and poorer function
35 (66%) patients underwent follow-up ultrasound

- 32 were intact and normal thickness
- 3 were predominantly intact with small area of partial thickness tearing

Significant number lost to follow-up

- Geographical considerations
Discussion

Strengths
- High follow-up rate
- Consistent data collection
- Minimal participation bias
- Heterogenous sample population
- Multiple surgeons

Weaknesses
- Small sample size (limited power)
- Possible confounding surgical factors
- Non-standardised post-operative treatment
- Ceiling effect of DASH
Summary

• This is the first study to examine serum markers as prognostic factors for shoulder surgery

• Treatment of RCD remains a complicated process with no clear guidelines or conclusions on best practice

• More research required to:
  • Confirm or establish an association between markers of adiposity or poor glycaemic control, and tendon disease in the shoulder
  • Better identify prognostic factors for surgery in RCD so that we can make more individualised decisions on patient treatment\textsuperscript{7,20}
Acknowledgements

- Bethesda Hospital
- Western Diagnostic Pathology
- Dr Bill Breidahl (Perth Radiological Clinic)
- Surgeons - Dr Grant Booth, Dr Sven Goebel, Dr Jonathan Spencer, Dr Paul Khoo, Dr Mark Hurworth, Dr Aaron Tay
References


References


Thank you

JUST THIS MANY

QUESTION