Sharing from the First Joint Replacement Centre in Hong Kong: Challenges and Looking Forward

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Consultant O&T
Background

- Growing demand
- Longer and longer waiting time
- Increasing backlogs

- Annual throughput by QEH: 250 operations
- Waiting Time: 53 months
- Backlogs: 1000 cases
• **Challenge** to the corporate
• QEH: >100% bed occupancy and operation theatre already fully utilized

• First specialized Joint Replacement Center commenced serviced on 15\(^{th}\) December 2010
• Aimed yearly throughput 500 cases
What is unique in BH JRC?

- Buddhist Hospital is a convalescent hospital
- Only Joint Center that perform primary joint reconstruction procedure only
- An ultra major operation
- No ICU support, limited laboratory support
- On call physician peri-operative support

**Challenge**

- Safety in peri-operative care
- Detail inter hospital transfer mechanism
Challenge to corporate

- Aging population
- Increased acceptance of joint replacement surgery
- More aware of the benefits of clinical outcomes
- Despite opening of more joint centers
Evidence Based Practice
Cost Effectiveness
Patient Satisfaction

Integrated Patient Management Pathway (IPMP)
Enhanced Recovery After Surgery (ERAS)
ERAS protocol for TJA

Sick-patient model → Well-patient model

- Surgical stress, metabolic and endocrine derangements and prolonged immobilization contribute to ‘organ dysfunction’
- Pre-operative
- Intra-operative
- Post-operative
- Audit
- Tailor made for each center
ERAS protocol for TJA

• **Pre-operative**
• **Education**
• **Nutrition**: carbohydrate loading
• **Liberal fasting**: traditional FMN may cause volume depletion and affect pain thresholds and response to anesthetic agents
• **Optimization**: detect and correct **anemia**
• **Active pre-warming**
• **Pre emptive oral analgesia** - stay ahead of pain and limit total analgesia requirement
Education

- Twice a month **consent class** for patient and relatives (care companion)
- Lead by subspecialty nursing staff
- Informed consent, points to noted peri operation, virtual journey inside operation theatre
- Great relief of anxiety and modify expectation
- Understand post op plan
- Padilla (JOA 2019): modifying expectations can significantly improved patient satisfaction and lower LOS after THR
Research Activities by Physiotherapy Department

- Collaboration between O&T and Physiotherapy Department
- To evaluate the contribution of hip abductor muscle strength to functional performance in patients with TKA
- To direct an evidence-based peri-operative rehabilitation protocol in the Joint Replacement Centre (JRC) of HKBH
- A prospective longitudinal study design repeated measurements over 6 months following TKA
- From January to March 2013

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Quadriceps Strength

Hip Abductor Strength

Functional Assessments

Timed Up and Go Test

5 Chair-Rise Test

Stair Ascend/Descend Test

Handheld dynamometer
Result

- Quadriceps muscle and hip abductor muscle strength were **significant contributors** to functional performance in *patients with Knee OA after TKA*

- Hip abductor muscle strength **influenced more** on functional outcome

- Hip abductor muscle **not directly** over incision site → Facilitate strengthening

- Not only focus on quadriceps muscle strengthening, but also emphasize on *hip abductor muscle enhancement* in the clinical pathway of the peri-operative rehabilitation regime

- **Continuous Quality Improvement project**: Incorporate hip abduction strengthening exercises into Integrated Patient Management Pathway (IPMP) for TKR
ERAS protocol for TJA

- **Intra-operative**
  - RA: *multimodal* management (spinal, CSE, PNB, LIA)
  - Short acting sedative hypnotic
  - Goal: *normothermia* reduce infection, cardiac complications, coagulopathy and transfusion requirements
  - Goal: *normovolemic*
  - Blood conservation
  - Antibiotic prophylaxis
ERAS protocol for TJA

- **Intra-operative**
- **RA** (spinal, CSE, PNB, LIA)
  - Combination of LA, adrenaline and NSAID
  - Simple, surgeon directed, infiltrate directly into pain source
  - LIA group has shorter LOS compared with PNB (Spanghel, 2015)
  - LIA: Better pain relief, earlier recovery of knee flexion and lower incidence of PONV (Tsukada, 2014)
- Short acting sedative hypnotic
- Goal: normothermia
- Goal: normovoleemia
- Blood conservation
- Antibiotic prophylaxis

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Blood conservation

• Risk of transfusion: infection, non-infectious include immune mediated and nonimmune mediated
• Increase length of stay
• Psychological impact: Increase sick role and delay mobilization
• Use of antifibrinolytic drug tranexamic acid popularized
• Numerous publications demonstrating clinical and cost efficacy
• Irrespective of route of administration
Percentage of Blood Transfusion TKR&THR (2011-18)

- Total
- TKR
- THR

Year: 2011 - 2018

2011: 47% (Total), 46% (TKR), 50% (THR)
2012: 47% (Total), 46% (TKR), 50% (THR)
2013: 49% (Total), 49% (TKR), 50% (THR)
2014: 25% (Total), 13% (TKR), 12% (THR)
2015: 25% (Total), 10% (TKR), 10% (THR)
2016: 21% (Total), 13% (TKR), 11% (THR)
2017: 25% (Total), 17% (TKR), 19% (THR)
2018: 3% (Total), 2% (TKR), 5% (THR)

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ERAS protocol for TJA

• **Post-operative**
  • Multimodal opioid sparing analgesia
    • Combination of analgesics act differently
    • Lower dosage required
    • Lower side effects
    • Paracetamol and NSAID, oxycodone
    • Non pharmacological means
• PONV prophylaxis
• Early mobilization
• Early oral intake
The Societal Cost of Total Knee Replacement for End-Stage Knee Osteoarthritis: A pilot Cost Effectiveness Analysis in Hong Kong

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Quality adjusted life-year (QALY)

- Two components:
  - Quality of life (in a 0-1 scale)
  - Time-span (years)

- Utility:
  - the preference for a particular health state
  - min. 0 (i.e. dead)
  - max. 1 (i.e. perfect health)
  - Can be calculated by scoring systems e.g. WOMAC, SF-12
Patient Characteristics

- Total number: 431 (428 at 5 Yr FU)
- Average Age: 69.2 ± 6.8 (52-85)
- Female proportion: 84.4%
- Wait Time to Surgery (months): 16
- BMI: 27.16 ± 4.18
- ASA physical status (median): 2
- Baseline PCS score (SD): 23.03 ± 10.02
- Baseline MCS score (SD): 40.51 ± 14.15
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<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Total number</strong></td>
<td><strong>431</strong></td>
</tr>
<tr>
<td><strong>Mean age</strong></td>
<td><strong>69.2 ± 6.8</strong>&lt;br&gt;(52-85)</td>
</tr>
<tr>
<td><strong>% Male</strong></td>
<td><strong>15.6%</strong></td>
</tr>
<tr>
<td><strong>Mean FU, months</strong></td>
<td><strong>65.2 ± 8.6</strong></td>
</tr>
<tr>
<td><strong>Mean BW, kg</strong></td>
<td><strong>65.44 ± 11.29</strong></td>
</tr>
<tr>
<td><strong>Mean Height, cm</strong></td>
<td><strong>154.06 ± 16.6</strong></td>
</tr>
<tr>
<td><strong>Mean BMI</strong></td>
<td><strong>27.16 ± 4.18</strong></td>
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## Pre-op SF-12 Subscales

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Score</th>
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<tbody>
<tr>
<td>PF</td>
<td>38.43 ± 19.11</td>
</tr>
<tr>
<td>RP</td>
<td>28.47 ± 37.82</td>
</tr>
<tr>
<td>RE</td>
<td>43.83 ± 45.72</td>
</tr>
<tr>
<td>VT</td>
<td>51.48 ± 19.41</td>
</tr>
<tr>
<td>EW</td>
<td>64.70 ± 18.68</td>
</tr>
<tr>
<td>SF</td>
<td>64.47 ± 27.78</td>
</tr>
<tr>
<td>BP</td>
<td>50.32 ± 22.83</td>
</tr>
<tr>
<td>GH</td>
<td>51.39 ± 17.07</td>
</tr>
</tbody>
</table>
SF-12 Physical Domains after TKR
SF-12 Mental Domains after TKR

- Social Fx.
- Mental Health
- ER Fx.
- Vitality

Timepoints: OPD, IPO, 6mo, 1Yr, 2Yr, 5Yr

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WOMAC subscales before & after TKR

Phy.Fx
Pain
Stiffness

OPD IPO 6mo 1Yr 2Yr 5Yr
## Functional & QoL Outcomes

<table>
<thead>
<tr>
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<th>Pre-op</th>
<th>Post-op</th>
<th>Mean change</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOMAC</td>
<td>43.25 ± 17.54</td>
<td>6.76 ± 9.83</td>
<td>-36.49</td>
</tr>
<tr>
<td>KOOS (QoL)</td>
<td>56.81 ± 17.62</td>
<td>69.44 ± 16.43</td>
<td>12.63</td>
</tr>
<tr>
<td>KOOS</td>
<td>59.79 ± 18.59</td>
<td>82.03 ± 10.23</td>
<td>22.24</td>
</tr>
<tr>
<td>PCS</td>
<td>23.03 ± 10.02</td>
<td>34.57 ± 8.52</td>
<td>11.54</td>
</tr>
<tr>
<td>MCS</td>
<td>40.51 ± 14.15</td>
<td>46.25 ± 6.85</td>
<td>5.74</td>
</tr>
<tr>
<td>SF-6D Utility Value</td>
<td>0.57 ± 0.09</td>
<td>0.67 ± 0.11</td>
<td>0.10</td>
</tr>
<tr>
<td>QALY gained*</td>
<td></td>
<td>0.154</td>
<td></td>
</tr>
</tbody>
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*Discount rate=3%
Overall Length of Stay: Avg. 8.81
Complications

- Total no. of operations: 431
- Superficial wound infection: 8 (0.02%)
- Deep wound infection: 1 (0.002%)
- Clinical DVT: 0
- Pulmonary Embolism: 1 (0.002%)
## Direct Medical Cost

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgeon’s Fee</td>
<td>49,110</td>
</tr>
<tr>
<td>Anaesthetist’s Fee</td>
<td>20,460</td>
</tr>
<tr>
<td>Operation Theatre Fee</td>
<td>12,280</td>
</tr>
<tr>
<td>Implant &amp; Consumable Charge</td>
<td>16,224</td>
</tr>
<tr>
<td>Room &amp; board (9 days)</td>
<td>59,850</td>
</tr>
<tr>
<td>Ward round Fee (9 days)</td>
<td>10,800</td>
</tr>
<tr>
<td>Physiotherapy Fee (7 days)</td>
<td>3,850</td>
</tr>
<tr>
<td><strong>Total (TKR)</strong></td>
<td><strong>172,574</strong></td>
</tr>
<tr>
<td>6 physiotherapy sessions a year (x5)</td>
<td>16,500</td>
</tr>
<tr>
<td>Drug Fee (NSAID 60 months)</td>
<td>15,450</td>
</tr>
<tr>
<td>Viscosupplement Injection (x3)</td>
<td>7,200</td>
</tr>
<tr>
<td><strong>Total (Non-operative Treatment)</strong></td>
<td><strong>39,150</strong></td>
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What is ICER?

**Incremental Cost-Effectiveness Ratio (ICER)**

\[
ICER = \frac{(C_1 - C_0)}{(E_1 - E_0)}
\]

- \(C_1\) = cost in intervention group
- \(C_0\) = cost in control group
- \(E_1\) = effect in intervention group
- \(E_0\) = effect in control group
Cost Effectiveness

• Incremental cost-effectiveness ratio (ICER), representing the cost-per-point change in outcome score:
  • WOMAC : HKD 472,935
  • KOOS : HKD 775,962
• Cost-per-Utility/QALY gained (ICUR):
  • Utility : HKD 1,725,740
  • QALY : HKD 1,120,610

=143,668 USD
<200,000 USD
(US Threshold)
Conclusion

• From societal health perspective, primary joint reconstruction surgery is a cost effective procedure to provide lasting functional improvement for elderly patients
• Cost analysis is important in the practice of orthopaedics
• Cost measurement is a continuous process, spanning across the whole patient’s care cycle
• **Acknowledgement**
  
  • Dr Andy Chan, physiotherapy department KCC
  • Ms Boogie Yung, physiotherapy department KCC
Thank You