Can Specific Implant Designs Implicate Variations in Outcomes of Total Ankle Arthroplasty?

Dahang Zhao, MD, PhD
Dichao Huang, MD
Gonghao Zhang, MD
Chen Wang, MD, PhD
Xin Ma, MD, PhD
Huashan Hospital, Fudan University
Shanghai, China
Disclosure

NO CONFLICT OF DISCLOSURE

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We have no potential conflicts with this E-poster
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- **Background**
  - Rates of complication, reoperation, long-term survivorships after Total ankle arthroplasty (TAA) were not yet comparable to hip and knee
    - On the one hand: TAA implant preferences changed, indications extended and the complications rates decreased after training course
    - On the other hand: some complications could be avoided or decreased with experience but some others persisted unchanged

- **Hypothesis**
  - Different implant design could implicate some variations in complications and radiographic findings

- The purpose of this study is to investigate whether there were variations among patients after TAA used different implants in term of
  - Intraoperative complications
  - Postoperative complications
  - Postoperative radiographic findings
  - Reoperation and failure rates
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- **Methods**: literature search of MEDLINE, EMBASE, Cochrane Library
  - **Inclusion criteria**
    - Studies of primary TAA used cementless prosthesis
    - A minimum follow-up of no less than 2 years
    - Including reports of complication, secondary procedure and radiographic evaluation
  - **Exclusion criteria**
    - Studies reported on a same cohort of patients at shorter follow-up
    - Studies reported on a small cohort of patients completely included in another study
    - More than one type of prosthesis used without separated data
  - **Study selection**
    - 139 irrelevant records
    - 175 reviews, 48 case reports, 1 retracted paper
    - 584 articles did not meet inclusion criteria or met exclusion criteria
    - 854 papers remaining
    - 630 papers remaining
    - 46 studies remaining
    - 993 for initial review after deduplication and deleting 94 non-English records

- **Thus, 58 studies for final review** (33+25)
  - As 25 groups, which extracted from the 13 comparative studies, had separate data
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Methods

- Data extraction and methodology
  - **Research subject:** different type of implant
  - **Confounding factors:** mean age, etiology, preoperative coronal deformity, surgeon experience, mean follow-up years
  - **Intraoperative complications**
  - **Postoperative complications including 7 categories:** wound healing problem, deep infection, instability or polyethylene (PE) insert fracture, pain or stiffness, malalignment, impingement, fracture
  - **Radiographic outcomes including 4 categories:** loosening in tibia, loosening in talus, cyst in tibia, cyst in talus
  - **Reoperation:** defined as subsequent surgery without removal of metallic component
  - **Failure:** defined as revision (exchange any of metallic component), convert to arthrodesis and amputation

Statistics

- To investigate whether prosthesis could implicate variations in each complications and radiographic findings by controlling other confounding factors using **multivariate multilevel mixed-effects logistic regression**
- Statistical analysis was done using STATA 13.1
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- **Results**
  - Postoperative complications (STAR was set as reference)

<table>
<thead>
<tr>
<th>Prosthesis</th>
<th>Wound healing</th>
<th>Deep infection</th>
<th>Instability or PE insert fracture</th>
<th>Pain or stiffness</th>
<th>Malalignment</th>
<th>Impingement</th>
<th>Fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>P value</td>
<td>OR</td>
<td>P value</td>
<td>OR</td>
<td>P value</td>
<td>OR</td>
</tr>
<tr>
<td>AES</td>
<td>0.333</td>
<td>0.393</td>
<td>-</td>
<td>-</td>
<td>3.234</td>
<td>0.148</td>
<td>-</td>
</tr>
<tr>
<td>Agility</td>
<td>3.531</td>
<td>0.094</td>
<td>0.893</td>
<td>0.898</td>
<td><strong>5.968</strong></td>
<td>0.049</td>
<td>2.333</td>
</tr>
<tr>
<td>BOX</td>
<td>0.125</td>
<td>0.112</td>
<td>0.798</td>
<td>0.857</td>
<td>0.063</td>
<td>0.038</td>
<td>1.360</td>
</tr>
<tr>
<td>BP</td>
<td>1.305</td>
<td>0.614</td>
<td>0.467</td>
<td>0.283</td>
<td>0.676</td>
<td>0.514</td>
<td><strong>0.081</strong></td>
</tr>
<tr>
<td>CCI</td>
<td>0.829</td>
<td>0.845</td>
<td>0.155</td>
<td>0.213</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HINTegra</td>
<td>1.297</td>
<td>0.592</td>
<td><strong>0.213</strong></td>
<td>0.023</td>
<td>0.106</td>
<td>0.002</td>
<td>0.681</td>
</tr>
<tr>
<td>INBONE</td>
<td>1.083</td>
<td>0.908</td>
<td>0.677</td>
<td>0.667</td>
<td>0.025</td>
<td>0.003</td>
<td><strong>5.824</strong></td>
</tr>
<tr>
<td>INBONE II</td>
<td>0.312</td>
<td>0.273</td>
<td>-</td>
<td>-</td>
<td>0.019</td>
<td>0.001</td>
<td>2.014</td>
</tr>
<tr>
<td>LCS</td>
<td><strong>37.99</strong></td>
<td>0.000</td>
<td>2.536</td>
<td>0.396</td>
<td><strong>54.89</strong></td>
<td>0.000</td>
<td>-</td>
</tr>
<tr>
<td>Mobility</td>
<td>2.083</td>
<td>0.247</td>
<td>0.710</td>
<td>0.639</td>
<td>0.376</td>
<td>0.152</td>
<td>3.908</td>
</tr>
<tr>
<td>Salto</td>
<td>0.000</td>
<td>1.000</td>
<td>0.427</td>
<td>0.452</td>
<td>0.583</td>
<td>0.529</td>
<td>1.053</td>
</tr>
<tr>
<td>Salto Talaris</td>
<td>1.071</td>
<td>0.903</td>
<td>0.222</td>
<td>0.175</td>
<td>-</td>
<td>-</td>
<td><strong>4.139</strong></td>
</tr>
</tbody>
</table>

*blue tagged means positive & red tagged means negative*
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- Results
  - Intraoperative complications, radiographic findings, reoperation and failure (STAR was set as reference)

<table>
<thead>
<tr>
<th>Prosthesis</th>
<th>Intraoperative complications</th>
<th>Radiographic findings</th>
<th>Reoperation</th>
<th>Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR P value</td>
<td>OR P value</td>
<td>OR P value</td>
<td>OR P value</td>
</tr>
<tr>
<td>AES</td>
<td>- -</td>
<td>0.072 0.060</td>
<td>0.915 0.941</td>
<td>4.785 0.246</td>
</tr>
<tr>
<td>Agility</td>
<td>1.122 0.914</td>
<td>29.18 0.000</td>
<td>19.46 0.000</td>
<td>4.863 0.133</td>
</tr>
<tr>
<td>BOX</td>
<td>0.228 0.256</td>
<td>1.148 0.890</td>
<td>1.086 0.940</td>
<td>- -</td>
</tr>
<tr>
<td>BP</td>
<td>1.117 0.867</td>
<td>0.275 0.023</td>
<td>1.117 0.849</td>
<td>0.497 0.385</td>
</tr>
<tr>
<td>CCI</td>
<td>2.686 0.415</td>
<td>1.967 0.510</td>
<td>6.725 0.106</td>
<td>1.366 0.830</td>
</tr>
<tr>
<td>HINTEGRA</td>
<td>1.146 0.821</td>
<td>0.524 0.173</td>
<td>0.584 0.302</td>
<td>0.323 0.111</td>
</tr>
<tr>
<td>INBONE</td>
<td>0.221 0.155</td>
<td>0.097 0.007</td>
<td>9.304 0.001</td>
<td>0.027 0.010</td>
</tr>
<tr>
<td>INBONE II</td>
<td>0.920 0.945</td>
<td>0.070 0.045</td>
<td>1.170 0.876</td>
<td>- -</td>
</tr>
<tr>
<td>LCS</td>
<td>- -</td>
<td>0.478 0.528</td>
<td>3.512 0.259</td>
<td>5.341 0.277</td>
</tr>
<tr>
<td>Mobility</td>
<td>2.636 0.230</td>
<td>1.709 0.398</td>
<td>1.579 0.525</td>
<td>0.224 0.094</td>
</tr>
<tr>
<td>Salto</td>
<td>- -</td>
<td>4.504 0.106</td>
<td>0.359 0.388</td>
<td>1.758 0.662</td>
</tr>
<tr>
<td>Salto Talaris</td>
<td>0.556 0.438</td>
<td>1.538 0.462</td>
<td>1.372 0.633</td>
<td>0.125 0.040</td>
</tr>
</tbody>
</table>

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- Discussion
  - Limitations
    - Only 1 or 2 studies of CCI, LCS, AES, Salto, BOX, INBONE II, Agility were included in this survey
    - Preoperative deformity in 4 studies and mean follow-up in 1 study were estimated, and in 18 studies were not reported
    - Criteria for experienced surgeon judgement in some studies depend on whether the surgeon was a TAA performer in a former published study
    - No uniform guideline for appropriate follow-up or preemptive surgical intervention
    - No replies from the senior authors of some early published studies.
    - Without replies from authors, some non-mentioned complications or radiographic findings were considered “none”, which resulted in invalid statistical results of items

- Intraoperative complication
  - Some studies have suggested that intraoperative complications rate of total ankle replacement is reduced by surgeon experience
  - Our result is consistent with those which no difference was found after controlling the factor of surgeon experience
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• Discussion
  • More wound healing problems in LCS
    • LCS was an old prosthesis with unsatisfactory instrumentation which might increase the risk of wound problem
  • Less deep infections and less postoperative fracture in HINTEGRA
    • Much less bone resection
  • Less instability or PE insert fracture in INBONE and HINTGRE
    • Saddle articular surface of INBONE and sulcus of articular surface of INBONE II could accommodate substantial amounts of varus or valgus tilt, but our result could not indicate the different between Saddle and sulcus for preventing varus or valgus tilt
    • Anatomical resurfacing of talus result in physiological load transfer and minimal deformation forces
    • Early all PE insert fracture are from STAR
  • More pain of stiffness in INBONE and Salto Talaris
    • The unique instrumentation of INBONE might be the reason for pain
    • More postoperative synovectomy or Achilles tendon lengthening for stiffness relief from the studies using Salto Talaris, which were all published recently
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- **Discussion**
  - Less tibial loosening but more talar loosening in INBONE and INBONE II
    - Only implant using intramedullary fix system which is similar with that obtained by press-fit femoral stems in total hip arthroplasty
    - Only implant using intramedullary guidance from heel might compromise the talar arterial blood supply, which result in collapse of the talar component and osteonecrosis of the talus
  - More talar cyst in AES and Agility
    - Smaller PE insert of AES and noncongruence between talar component and PE insert of Agility result in much more wear particles, which could incite a chronic inflammatory process that lead to osteolysis
  - More reoperation in Agility
    - Our result was the same as those published previously
  - Less failure in Salto Talaris
    - Two components and fix bearing implant which is similar as INFINITY and Cadence
    - Replicate the anatomical features of talus, which is truncated conical shape and asymmetry surface
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References: blue tagged studies included 2 groups & red tagged study included 1 group

- Haytmanek CT Jr, et al. Foot Ankle Int. 2015;36(9):1038-44.