Percutaneous Externally Assembled Laparoscopic (PEAL) Donor Nephrectomy: A Cohort Pain Comparison
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Introduction
- First laparoscopic nephrectomy was performed in 1991 by Clayman, Kavoussi, et al.
- Incorporated into donor nephrectomies over time
- Donor nephrectomies technically demanding
  - Need to preserve vascular length
  - High profile patients contributing voluntarily to social good so increased pressure to avoid complications
- Most common post-operative complaints are unexpected pain and cosmetic impact

Methods
- Novel Percutaneous Externally Assembled Laparoscopic (PEAL) instruments developed to decrease incisional pain and improve cosmesis (Figure 1)
- Assembly shown in Figure 2
- Reusable handpiece
  - 2.96 mm shaft with no skin or fascial closure necessary
  - Similar grasping strength to traditional 5 mm laparoscopic instrument
- Currently manufactured by Teleflex (Morrisville, NC) under name Percuvance®

Figure 1A: A PEAL instrument consists of a 2.96 mm instrument shaft with a 5 mm instrument tip.
Figure 1B: Four different PEAL tips are available including an introducer tip, fenestrated grasper, dissector and scissors.

A) The introducer tip is attached to the shaft and placed directly through skin after a small stab incision.
B) The tip is directly visualized as it is introduced.
C) The tip is passed outside the patient through the multi-access port.
D) The introducer tip is removed and the desired instrument tip is screwed into place.
E) The assembled instrument is brought back into the abdominal cavity for use during the surgery.

Methods (continued)
- Five healthy kidney donors consented to use of PEAL instruments from July 2016 to February 2017
- All performed using hand-assisted technique
- PEAL instrument replaced traditional laparoscopic port
- Single surgeon
- Compared to control group of fifteen healthy kidney donors over same period for whom no PEAL instruments were used
  - Three surgeons
  - Hand-assisted and traditional laparoscopic techniques previously found to have similar outcomes
- Primary outcome was length of stay (typically dependent on pain control)
- Secondary outcomes included operative time, opiate usage, in morphine equivalents, and subjective cosmesis

Results

<table>
<thead>
<tr>
<th></th>
<th>PEAL</th>
<th>Non-PEAL</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time (min)</td>
<td>208</td>
<td>297</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Opioid usage per day (mg morphine equiv)</td>
<td>10.3</td>
<td>10.2</td>
<td>0.96</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>2.1</td>
<td>2.1</td>
<td>0.99</td>
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Table 1: Operative and post-operative outcomes

![Liver retractor site, 5 mm port, 10 mm scar](image)

Discussion
Donor nephrectomies require exceptional technical excellence both to ensure maximum viability of the donor kidney as well as to minimize morbidity to the otherwise healthy donor. The most common post-operative complaints are unexpected pain and more visible scars than expected. While reducing these complaints is desirable, it cannot be done at the expense of the quality of the kidney obtained. The PEAL instruments improve cosmesis and minimize pain without sacrificing technical capability. We have previously demonstrated that the 5 mm tips of the PEAL instrument are functionally similar to conventional 5 mm laparoscopic instrumentation. The outer diameter of a 5 mm conventional laparoscopic port actually produces a 10-12 mm scar. PEAL instruments are placed without a port and allow the largest, stiffest instrument shaft possible to be placed through a true 3 mm puncture. While the PEAL group did not have a significantly different length of stay or opioid usage, operative times were shorter by 89 minutes on average, possibly due in part to improved technical advantages. In addition, they produce a clearly superior cosmetic outcome as shown in Figure 3.

Conclusions
1. Donor nephrectomies using PEAL instruments have similar length of stay and opioid usage to non-PEAL cases
2. Donor nephrectomies using PEAL instruments averaged 89 minutes less operative time than non-PEAL cases
3. Donor nephrectomies using PEAL instruments had improved cosmetic outcomes

References