Robotic surgery “the da Vinci system”

A robot can be defined as any mechanical device that operates automatically with human like skills, from the surgeons’ point of view it is an information system with moving arms. It can be either passive, used to position and hold tools, or active, that moves the tools on surgeon’s command.

The da Vinci system was first developed by the Defense Advanced Research Projects Agency (DARPA) for remote battle-field surgery. The first cholecystectomy was performed 300 miles away using tele-surgery. The first robotic prostatectomy was performed in 2001, and the machine gained FDA approval in 2002.

**Basically it consists of three main parts:**

- Surgical console
- Robotic moving arms
- Instruments and imaging processing equipments
Advantages of the da Vinci system:
- Magnified (12x), stereoscopic 3-D vision
- Optimal hand-eye alignment
- Robotic wrist with high degree of freedom
- Comfortable seat posture-ergonomic
- Movements are scaled, and filtered.

Disadvantages:
- Expensive
  - $1.4 million cost for machine
  - $120,000 annual maintenance contract
  - Disposable instruments $2000/case
- Steep surgical learning curve
- Increased staff training/competence
- Increased OR set-up/turnover time
- Loss of tactile feedback

Clinical applications of the da Vinci system:
It can be applied almost in any field of surgery; however, it has been most commonly used in the following aspects of surgery:
- Urology: radical prostatectomy, dismembered pyeloplasty, radical cystectomy, cyst decortication
- Cardiac: mitral and aortic valve replacement, aorto-iliac bypass, off-pump synchronized bypass
- GYN: hysterectomy, prolapse repair, tubal reversals, fistula repair, myomectomy
- General: gastric bypass, Nissen
**Da Vinci prostatectomy compared to open radical prostatectomy:**

<table>
<thead>
<tr>
<th></th>
<th>Open</th>
<th>Robotic</th>
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<tbody>
<tr>
<td>OR time</td>
<td>4-5 hrs</td>
<td>2-4 hrs</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>8-10 days</td>
<td>24 hrs</td>
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<tr>
<td>Foley catheter</td>
<td>14 days</td>
<td>7 days</td>
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<tr>
<td>Blood loss</td>
<td>600 ml</td>
<td>&lt;100ml</td>
</tr>
<tr>
<td>Recovery</td>
<td>4-6 wk</td>
<td>2 wks</td>
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<tr>
<td>Pain</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>Scaring</td>
<td>more</td>
<td>less</td>
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**Advantages of da Vinci system over conventional laparoscopy:**

Generally, it has no advantage over standard laparoscopic approach for surgeries with no space limitations and when precise dissection is not necessary as cholecystectomy, and colectomy.