Surgical Assistants

• Efficacy of Procedure
  – Accuracy
  – Longevity
  – Invasiveness
• Augment human capabilities
  – Enabling new procedures
  – Reduced OR time
  – Reduced time under anaesthetic

Surgical Robots

• Autonomous
  – Robodoc (Curexo)
• Guided
  – RIO (Mako)
• Tele-Operated
  – daVinci (Intuitive Surgical Systems)
  – Sensei (Hansen Medical)
Autonomous Surgical Robots

Robodoc.com
Safety Systems

- Static balance
- Active-Release brake
- Back-Driveable joints
- Minimum torque motors
- Redundant sensors
- Sensing
  - Over-current
  - Over-heat
  - Over-speed joint
  - End-effector force
  - Loopback continuity

Guided Surgical Robots

Makosurgical.com
Autonomous / Guided (Planning Required)

The process flow diagram shows the following steps:

1. CT Scan
2. CT Data
3. Identify Anatomy
4. Surgical Pre-Plan
5. Plan Data
6. Drape Robot
7. Register Patient
8. Perform Surgery

Tele-operated Surgical Robots

Intuitivesurgical.com
Tele-operated Surgical Robots

Hansenmedical.com

Atrial Fibrillation Ablation

Remove (ablate) unwanted conduction paths in Atria