

Robots, Drones, and 3D Printing: A Risk Analysis of Replacing Humans with Modern Technology

Wednesday, September 19, 2018

Presented By the IADC Medical Defense and Health Law Committee and Product Liability Committee

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MEDICAL TECHNOLOGY THE ISSUES

- **CAN WE IMPROVE PATIENT OUTCOMES WITH MEDICAL TECHNOLOGY**
- **WILL THE ADVANCEMENT OF MEDICAL TECHNOLOGY INCREASE RISK EXPOSURE OR WILL THE BENEFITS OUTWEIGH SUCH RISK**
- **DOES THE STANDARD OF CARE REQUIRE IMPLEMENTATION OF NEW TECHNOLOGY**

Past Medical Technologic Advances

- Stethoscope 1816
- X-ray 1895
- Ekg 1903
- Dialysis 1943
- Fetal ultrasound 1956
- Pacemaker 1958
- Portable defibrillator 1966
- Ct scan 1971
- Ivf “test tube baby” 1978
- Artificial heart 1982
- Cloning 1996
- Stem cell therapy 1998
- Telesurgery 2001
- Visual prosthetic “bionic eye” 2007
- Artificial pancreas 2016



New Technological Advances

A. ROBOTS

- 1985: First robotic biopsy
- 1987: First robotic laparoscopic surgery 1987
- 1990: First robotic FDA approved surgery 1990
- 2000: First all encompassing robotic surgery DaVinci system approved by FDA 2000
- 2017: First robot to pass a medical licensing exam 2017



New Technological Advances

B. DRONES

- First drone developed for use by the CIA for targeted kill 2002
- First drone FAA approved for use in delivering medicine 2015



New Technological Advances

C. 3D PRINTING

- First patent filed for 3D printing in healthcare 1984
- First implanted bladder into human 2006
- First prosthetic leg 2008
- First fully cellular 3D bio-printed liver tissue 2013
- First total facial replacement 2014
- First blood vessel network 2017



A. ROBOTS



- **DA VINCI ROBOT:** PERFORMANCE OF SURGERY
- **XENEX ROBOT:** DISINFECTION OF HEALTHCARE FACILITY
- **TUG ROBOT:** 1,000 POUND TRANSPORT
- **RIBA ROBOT:** LIFT, CARRY, AND REPOSITION PATIENTS
- **VEEBOT:** INJECTIONS AND BLOOD DRAWS
- **MICROROBOTS:** DELIVERY OF DRUGS THROUGH BODILY FLUIDS
- **WATSON ROBOT:** MEDICAL DECISIONS

BENEFITS OF ROBOTS



- **DA VINCI:** PRECISION, ACCURACY, RECOVERY, REDUCES STAFF, LOWER COST
- **XENEX:** 70% REDUCTION IN INFECTION RATE, REDUCES STAFF, LOWER COST
- **TUG:** REDUCES INJURY, REDUCES STAFF, LOWER COST
- **RIBA:** REDUCES INJURY, REDUCES STAFF, LOWER COST
- **VEEBOT:** PRECISION, REDUCES STAFF, LOWER COST
- **MICRO:** PRECISION, RAPID DELIVERY, REDUCES STAFF, LOWER COST
- **WATSON:** FORMULAIC, REDUCES STAFF, LOWER COST

RISKS OF ROBOTS

- **Mechanical failure**
- **Physical injury to patient, staff**
- **Computer error**
- **Negligent dispensing of medication**
- **Contamination**
- **Errors committed by operator/programmer**
- **Patient reluctance**
- **Hacking/cyber attack**
- **Usual risks of surgery apply**
- **High cost to implement and maintain**
- **Weakens physician-patient relationship**

POTENTIAL EXPOSURE OF ROBOTS

- Professional liability
- Captain of the ship
- Learned intermediary
- Professional liability
- Product liability
- Informed consent
- Credentialing/training
- Regulatory issues
- Wrongful death
- Intellectual property
- Data breaches
- Breach of contract
- Personal injury
- Licensing



B. DRONES



- **TRANSPORT BLOOD PRODUCTS AND LABORATORY SAMPLES FOR TESTING**
- **TRANSPORT DEFIBRILLATORS AND OTHER LIFE SAVING EQUIPMENT**
- **TRANSPORT CONTRACEPTIVES AND OTHER MEDICAL SUPPLIES**
- **AIRDROP WHEN LANDING IMPOSSIBLE OR UNSAFE**
- **ACT AS PARAMEDIC**

BENEFITS OF DRONES

- Expeditious transport of life-saving medicine, devices, products
- Reaches rural, war-torn, and disaster areas
- Used in conjunction with telemedicine
- Rapid response
- Cost-effective
- Less staff
- Safety issues
- Site inspection
- FAA regulated



RISKS OF DRONES

- Drone failure
- Physical injury to patient or bystander
- Damage to property
- Contamination of product
- Contamination by the product
- Spoliation of product
- Operator error
- Air traffic issues



POTENTIAL EXPOSURE OF DRONES

- EQUAL PROTECTION
- PERSONAL INJURY
- PRODUCT LIABILITY
- BREACH OF CONTRACT
- MEDICAL MALPRACTICE
- WRONGFUL DEATH
- LACK OF INFORMED CONSENT
- GENERAL NEGLIGENCE
- PATENT INFRINGEMENT
- FAA VIOLATIONS
- CLASS ACTIONS
- FEDERAL ACTIONS



C. 3D PRINTING



- **3 DIMENSIONAL MODEL OF SURGICAL TARGET**
- **PROSTHETIC LIMBS**
- **ORTHOPEDIC AND OTHER IMPLANTABLE DEVICES**
- **SYNTHETIC ORGANS, SKIN, AND TISSUE WITH FUNCTIONING “BLOOD SUPPLY”**
- **PRINTABLE MEDICATIONS**

BENEFITS OF 3D PRINTING

- **SURGICAL PLANNING**
- **SURGICAL PRECISION**
- **LIFE-SAVING IMPLANTS**
- **RAPID PRODUCTION**
- **COST-EFFECTIVE**
- **ORGAN AND TISSUE REPLACEMENT**
- **LESS STAFF**
- **ENABLES RESEARCH WITHOUT USE OF LIVING SUBJECTS**



RISKS OF 3D PRINTING

- **CYBER SECURITY ISSUES**
- **BODILY INJURY**
- **TECHNOLOGY ERRORS AND OMISSIONS**
- **UNHEALTHY AIR EMISSIONS/WASTED ENERGY**
- **RELIANCE ON PLASTICS**
- **BIOETHICS CONCERNS**
- **ABUSE OF 3D PRINTED DRUGS**
- **BACTERIA INVADING PRINTERS**
- **FAILURE OF PRINTED “DEVICE”**

POTENTIAL EXPOSURE OF 3D PRINTING

PRODUCT LIABILITY

PROFESSIONAL LIABILITY

DEFECTIVE DESIGN/DEFECTIVE MANUFACTURING

FAILURE TO WARN

CYBER BREACH

INTELLECTUAL PROPERTY

STRICT LIABILITY AS TO COMMERCIAL SELLER

REGULATORY

PREEMPTION BY FEDERAL LAW

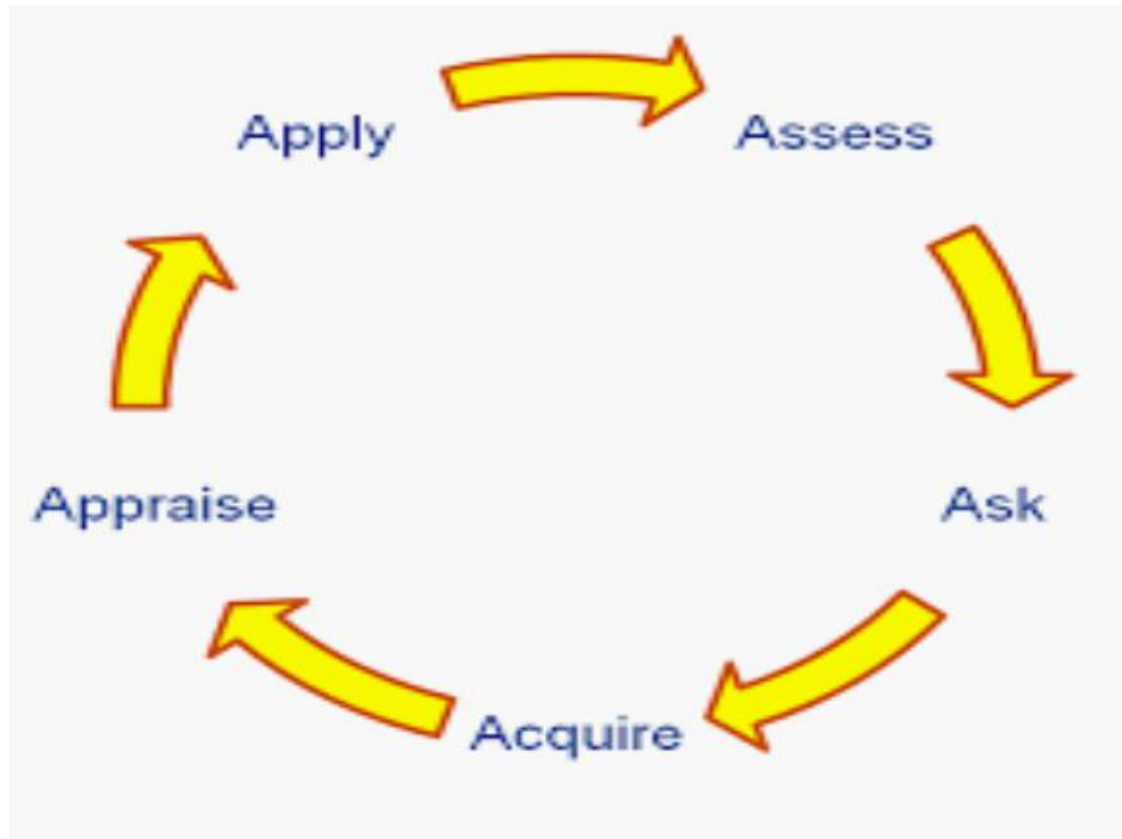


JURY INSTRUCTIONS

RE: STANDARD OF CARE

- CA: Failure to use the level of skill, knowledge, and care in diagnosis and treatment that *other reasonably careful medical practitioners* would use in the same or similar circumstances
- IL: Failure to use the same degree of knowledge, skill and ability as an *ordinarily careful professional* would exercise under similar circumstances
- NY: Failure to use *reasonable care* under the circumstances, doing something that a *reasonably prudent doctor* would not do under the circumstances, or failing to do something that a *reasonably prudent doctor* would do under the circumstances. It is a deviation or departure from accepted practice

PRUDENT, REASONABLE, CAREFUL



- DOES THE STANDARD OF CARE REQUIRE APPLICATION OF NEW TECHNOLOGY WHEN THE BENEFITS OUTWEIGH THE RISKS?

TAKEAWAYS

- **With the integration of innovative medical technology through the use of drones, robots, and 3D printing, the need for humans may be decreased while quality of care may be increased.**
- **Each application of new technology should be carefully analyzed to determine whether providers can benefit from the device and whether it will improve quality of care and reduce risk.**
- **When evidence demonstrates benefits outweighing the risks, the integration of medical technology should be employed and with time, may be required by the standard of care.**

Questions?



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