PD13-08
EVALUATION OF NERVE-HIGHLIGHTING CONTRAST AGENT GE3126 FOR IMAGE-GUIDED SURGERY

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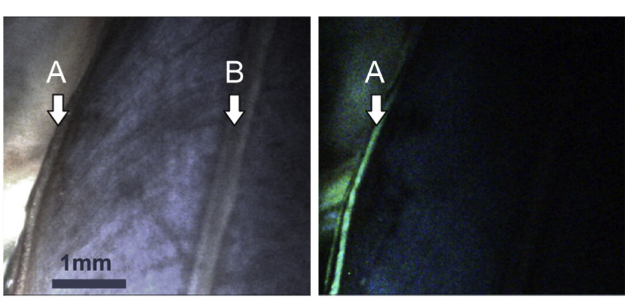
INTRODUCTION AND OBJECTIVES: Inadvertent injury to nerves is a significant and often inevitable consequence of surgery that can lead post-operative morbidity and loss of function. Nerve-sparing during radical prostatectomy can reduce the incidence of post-surgical erectile dysfunction. In retroperitoneal lymph node dissection for testis cancer, the prospective identification and preservation of nerves in is essential in maintaining ejaculatory function and fertility. Although there is a significant need, there is no widely adopted system for real-time identification of nerves in either the open or laparoscopic surgical settings. We sought to investigate the performance of a myelin-targeted fluorophore and optical imaging instrumentation in the intraoperative visualization of nerves.

METHODS: A myelin-targeting small molecule fluorophore, GE3126, was synthesized and characterized for its optical and myelin-binding properties using purified myelin basic protein. 2 Yorkshire pigs were utilized in a non-survival study. Peripheral and retroperitoneal nerves were exposed and control images taken using a dedicated compact imaging device adapted to both open and minimally-invasive approaches. Both white light and 405nm illumination were used. Following intravenous injection of the agent, blood, urine, and bile were drawn at fixed intervals to determine the pharmacokinetics of the agent. Central and peripheral nerves were visualized. Tissues were harvested for ex-vivo analysis and histopathology. 4 blinded observers evaluated captured images.

RESULTS: The primary route of excretion was renal. The fluorescence peak was achieved at 60-80 min following injection. Label/non-label fluorescence signal ratio was 5:1 at peak. Nerve to muscle signal was 7:1. Fluorescence polarization showed specific and strong binding to purified myelin basic protein. Retroperitoneal nerves from 100μm-10mm were evaluated. Inter-observer disagreement was 22% with white light images, and 0% with fluorescence images, which was confirmed by histology. No adverse effects were noted in the animals.

CONCLUSIONS: GE3126 provides a safe and effective means of identifying nerves through fluorescence imaging and is adaptable to both open and minimally invasive surgical procedures.



WHITE LIGHT GE2136

Two candidate sub-milimeter retroperitoneal nerves (A & B) are identified using white light laparoscopy (left). Upon illumination with 405nm laser light, GE3126 fluorescence from structure A is detected (right). On histopathologic analysis, A is confirmed as a nerve and B is identified as a blood vessel.

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PD13-09
DEVELOPMENT AND INITIAL PORCINE AND CADAVERIC EXPERIENCE WITH THREE-DIMENSIONAL PRINTING OF ENDOSCOPIC AND LAPAROSCOPIC EQUIPMENT

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INTRODUCTION AND OBJECTIVES: Recent advances in three-dimensional (3D) printing technology have made it feasible and potentially cost effective to print surgical devices in the operating theater. We report our initial experience with the printing and usage of endoscopic and laparoscopic disposable surgical equipment.

METHODS: We created computer-aided designs for ureteral stents and laparoscopic trocars using SolidWorks. Three generations of stents were printed with an Objet500 Connex printer and consisted of a rubber-like advanced black (TangoBlackPLus FLX980) material. A fourth generation was printed with an EOSINT P 395 printer and consisted of a Nylon elasto-polymer, Elasto Plastic. Trocars were printed with an Objet30 Connex printer. The trocar material consisted of a rigid opaque white material (VeroWhitePlus RDG835). We deployed the printed stents and trocars in an in vivo porcine model and in a cadaver model. We compared the printed trocars to two standard trocars for defect size and wound area using a digital caliper. Paired T-tests and an ANOVA test were performed to determine statistical significance.

RESULTS: Initial printed stent designs were 7Fr and 9Fr. Using contemporary printing technology, these stents could not be printed with a reliable lumen required to withstand the force of deployment. Next, we successfully printed a stent prototype with an outer diameter of 12Fr, which allowed passage of a 0.035 guide wire. The 12F stent characteristics limited its deployment using Seldinger technique, but the stent was successfully deployed in a female cadaver through a 12/14Fr ureteral access sheath using a rigid cystoscope. With technological advances, we printed and deployed a 9Fr stent in a porcine model with Seldinger technique. We successfully deployed first generation 3D printed trocars without difficulty. The trocars were fully functional for the creation and maintenance of pneumoperitoneum. The printed trocar had a larger superficial trocar defect area ($p < 0.001$) and superficial defect length ($p < 0.001$) compared to Karl Storz, and Ethicon trocars (29.41mm^2, 18.06mm^2, and 17.22mm^2 respectively and 14.29mm, 11.39mm, and 12.15mm, respectively).

CONCLUSIONS: 3D printing of ureteral stents and trocars is feasible, and these devices can be deployed in a porcine and cadaver model. While these prototypes require modification prior to clinical deployment, the rapid pace of technological advancement may make 3D OR printing a reality in the near-term future.

Source of Funding: None.

PD13-10
PROSPECTIVE RANDOMIZED STUDY COMPARING THE PHYSIOLOGIC EFFECTS OF VALVELESS INSUFFLATION SYSTEM AND CONVENTIONAL LAPAROSCOPIC INSUFFLATOR

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INTRODUCTION AND OBJECTIVES: We compared the physiologic effects and pain outcomes of patients undergoing laparoscopic renal surgery using the AirSeal valveless trocar system versus a conventional insufflation system.

METHODS: Patients undergoing laparoscopic renal surgery were randomized to either valveless (Vl) or conventional insufflation (CI). Patient demographics (age, race, ethnicity, body mass index), surgery performed (laparoscopic radical nephrectomy, nephroureterectomy, partial nephrectomy, cryoablation, or pyeloplasty), intraoperative events and physiologic parameters (operating time, items passed through trocars, blood loss, urine output, respiratory parameters, blood pressure, oxygen saturation, heart rate, stroke volume,