



ENDOUROLOGY SOCIETY 2014 Summer Student Scholarship

The Endourology Society is pleased to announce the following recipients of this year's **2014 Summer Student Scholarship**:

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2. Lauren Poniatowski
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Submitted by : Mr. Jaspreet Chhabra

“CREATING A HIGH FIDELITY PORCINE CADAVERIC MODEL FOR LEARNING NEPHRECTOMY AND PARTIAL NEPHRECTOMY”

INTRODUCTION

The surgical field of urology has seen a paradigm shift from the conventional open surgery to the present day state of the art minimally invasive surgeries incorporating endourology, laparoscopy and robotics. The ever-increasing patient burden, the incurring health care costs, medico-legal concerns and the need to shorten the learning curve warrants an intermediary to bridge the training lacunae. In pursuit of the same, several simulators and models have been devised. This has come into being from differing demands required to learn these minimally invasive forms of surgery. The hand-eye coordination, depth perception, lack of haptic feedback, physiological tremor are some of the concerns associated with laparoscopy.

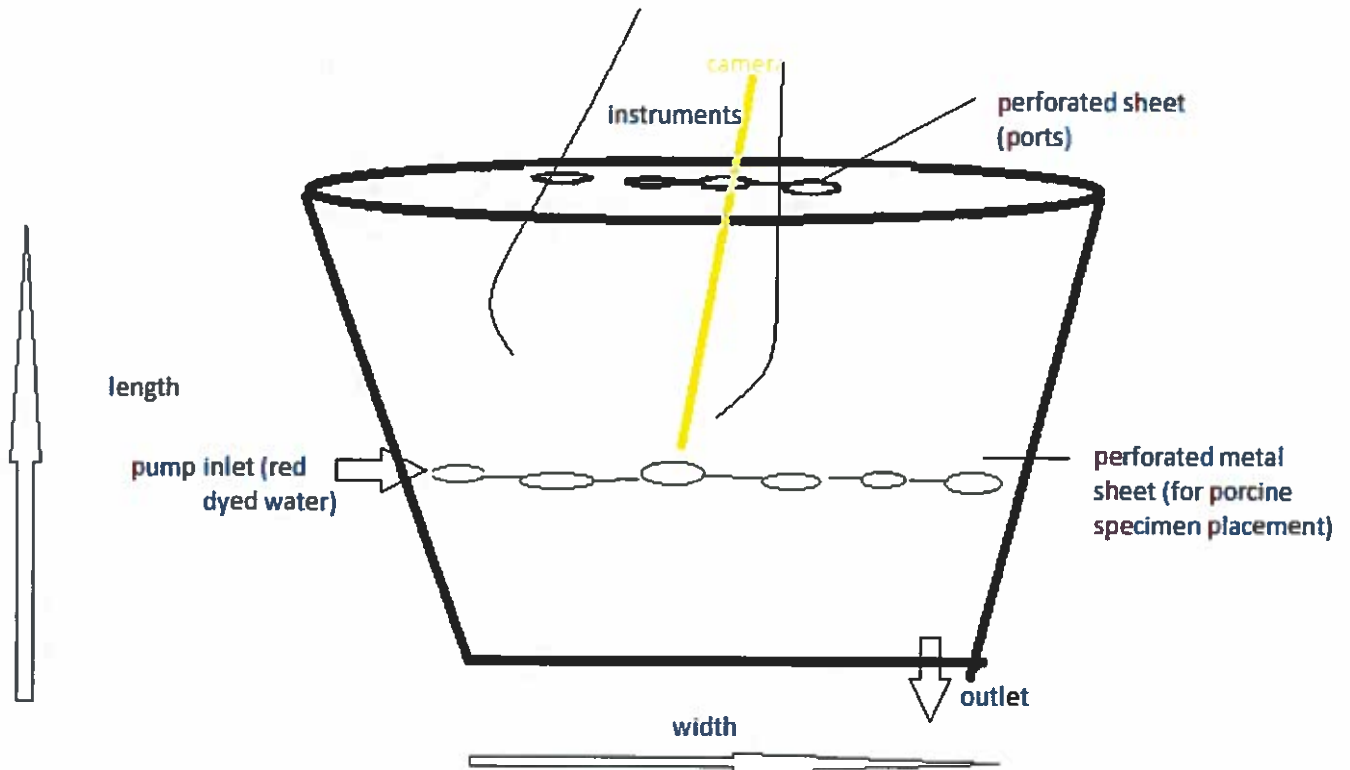
AIM

Both nephrectomy and partial nephrectomy require high level of skills when performed by laparoscopic means. Although there are ample of simulators reported in literature to shorten the learning curve and improve real time performance, our intent was to develop an indigenous simulator with low capital cost, but at the same time, one which mimics the real time tissue anatomy and surgical experience (including pulsatile perfusion).

MATERIAL AND METHODS

After obtaining Institutional Review Board approval, plan was made to proceed with the project. A butcher who is dedicated to supply animate models for our routine wet laboratory exercises was contacted and agreement made for provision of porcine cadavers.

- A) Porcine cadaver: a fresh porcine cadaver (*figure-1*) was utilized with specific instructions given to butcher to
 - i) Preserve great vessels up to infra renal segment
 - ii) Preserve tissue adjoining the kidney
- B) Pulsatile perfusion pump: UROPUMP (*figure-2*), an indigenous pump that we use for Ureteroscopy and other endourological procedures, was utilized for providing pulsatile perfusion to the cannulated great vessels thus mimicking the physiologic circulatory dynamics.
- C) Red dyed water- for resembling blood
- D) Laparoscopic training box
 - i) Box- a diagrammatic representation (Illustration 1) of simulator box model was discussed with and handed over to the professional. However, the final appearance of box made of steel alloy is as shown in *figure-3*.



(Illustration 1)

ii) cost for box manufacturing- Rs.6000/ box simulator (about 100 \$)

E) Instruments (*figure-4*)

- Basic laparoscopic instruments comprising of – laparoscopic scissors, Maryland forceps, graspers and hook were utilized.
- Scope- 30° telescope
- Energy source- Monopolar electro- cautery

- Suture material- silk, vicryl and monocryl 2-0 and 3-0
- Ureteric catheter (*figure-5*) - *This was initially intended to be used for partial nephrectomy model. However in view of difficulty in cannulation of the thin and narrow porcine ureter, we did not further incorporate it into our simulator model.*
- Liga clips
- Tumor marking simulation (for partial nephrectomy) - pre-scored circular rim of kidney with electro cautery (*figure-6*)

F) Groups

- Total nephrectomy-
 - Novices-12 (not versed with laparoscopy)
 - Experts- 9 (performed more than 10 cases independently)
- Partial nephrectomy
 - Novices- 8 (though perform laparoscopy but never performed partial nephrectomy)
 - Experts- 5 (performed more than 10 cases independently)

The novices were made to undergo prior dry lab exercises before embarking on to the simulation model, which comprised of basic tasks such as peg transfer, cutting a circle and single knot tying.

The performance of the two groups in *nephrectomy model* was assessed by Global assessment tool for evaluation of intraoperative laparoscopic skills (GOALS) which has proven reliability and validity for evaluation of technical skill by experienced raters. The metrics included depth perception, bimanual dexterity, efficiency, tissue handling, and participant autonomy to complete said task. Two independent scorers analyzed the performance of the study participants and each scorer (*figure-7*) could award a maximum of 5 points for each of the five metrics (maximum 25 points).

For *partial nephrectomy* the goal for the groups comprised of excising the pre-scored round area mimicking tumor (about 2cms in size) and noting the following parameters.

- Pedicle dissection time
- Mass resection time
- Suturing time

Each participant completed three attempts in their respective groups. Following this results were analyzed and *paired t-test* was used for computing statistical significance.

After completion of the exercise, expert participants filled out a post study questionnaire to assess realism of the training model (face validity) and its utility as a training tool (content validity) based on a 1 to 10 visual analogue scale (1 being worst and 10 being best).

RESULTS

TABLE 1: PERFORMANCE ON NEPHRECTOMY TRAINING MODEL AMONG GROUPS [#]

PARAMETER	NOVICE (n=12) MEAN $\pm$ S.D.	EXPERT (n=9) MEAN $\pm$ S.D.	P value (Expert v/s novice)
Depth Perception	2.56 $\pm$ 1.08	4.11 $\pm$ 0.58	0.0006
Bimanual dexterity	2.44 $\pm$ 0.98	3.74 $\pm$ 0.85	0.003
Efficiency	2.11 $\pm$ 0.96	3.81 $\pm$ 0.87	0.0003
Tissue handling	2.00 $\pm$ 0.88	3.89 $\pm$ 0.67	<0.0001
Autonomy	2.33 $\pm$ 0.94	4.33 $\pm$ 0.33	<0.0001

[#] Utilizing the GOALS Tool for assessment of laparoscopic skills

TABLE 2: PERFORMANCE ON PARTIAL NEPHRECTOMY TRAINING MODEL AMONG GROUPS

PARAMETER	NOVICE (n=8) MEAN $\pm$ S.D.	EXPERT (n=5) MEAN $\pm$ S.D.	P value (Expert v/s Novice)
Mean renal pedicle dissection time (mins.)	18.75 $\pm$ 3.54	14.73 $\pm$ 2.14	0.03
Mean mass resection time (mins.)	6.17 $\pm$ 1.52	4.40 $\pm$ 0.80	0.003
Mean suture time (mins.)	22.71 $\pm$ 3.73	17.27 $\pm$ 2.87	0.001

FACE AND CONTENT VALIDITY

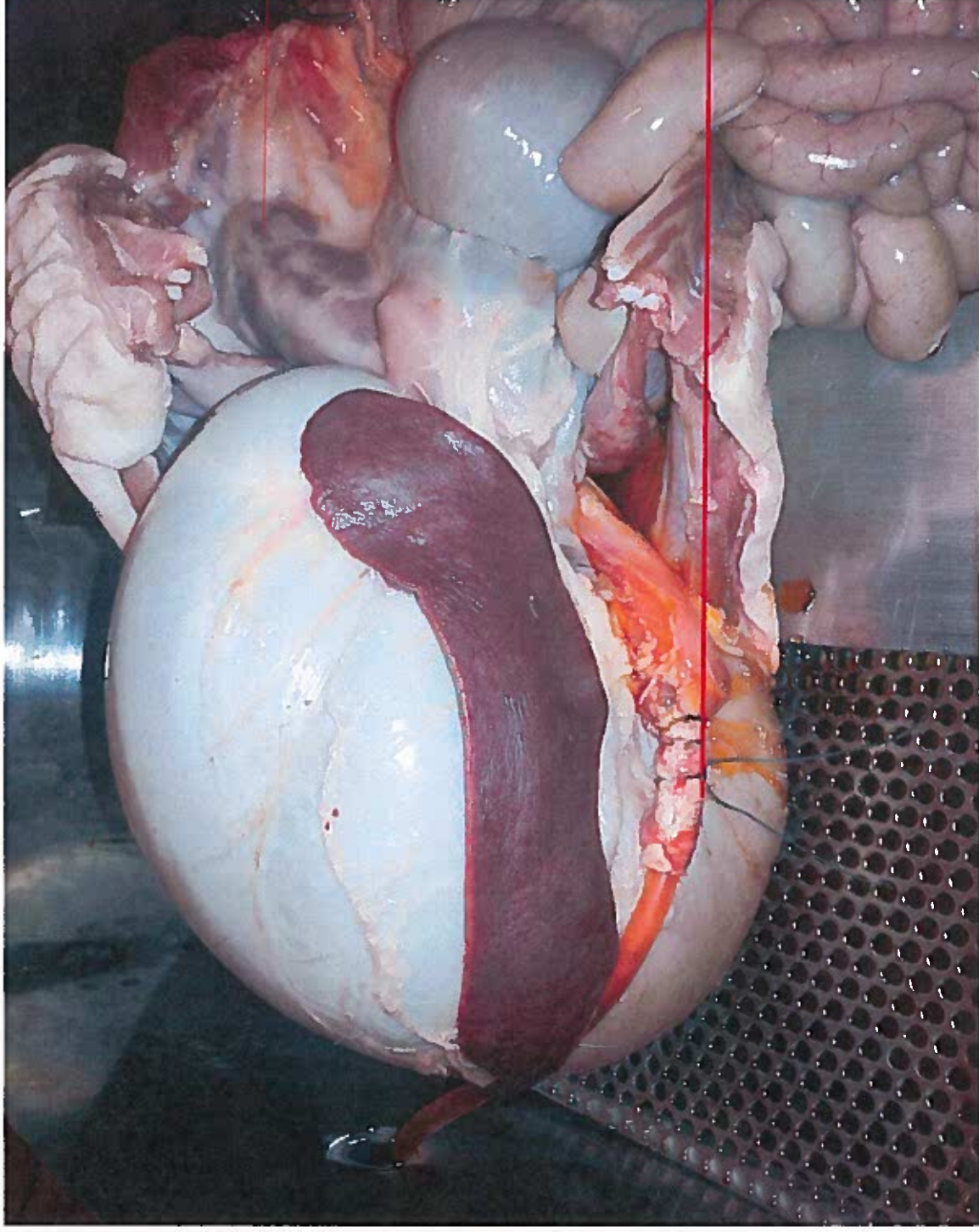
Overall, expert surgeons rated the training model as 'very realistic' (median score 7/10) (range: 6 – 9). Expert surgeons also rated the model as an 'extremely useful' training tool for novices (median score 9/10) (range: 8 – 10) although less so for experienced laparoscopic surgeons (median score 5/10) (range: 2 – 10)

CONCLUSION

There was a significant difference the way in which the novice and experts fared on the training model which gives a suggestion that training on the model will help the novice acquire skills for laparoscopic dissection and suturing. The face and content

validity suggests that the model closely mimics real time situation. The low cost involved in creating this model would help in training urologists in cost conscious developing countries.

- [For figures please refer to the accompanying power point presentation \(PPT\) slides.](#)



Porcine kidney (with
adjacent preserved tissue)

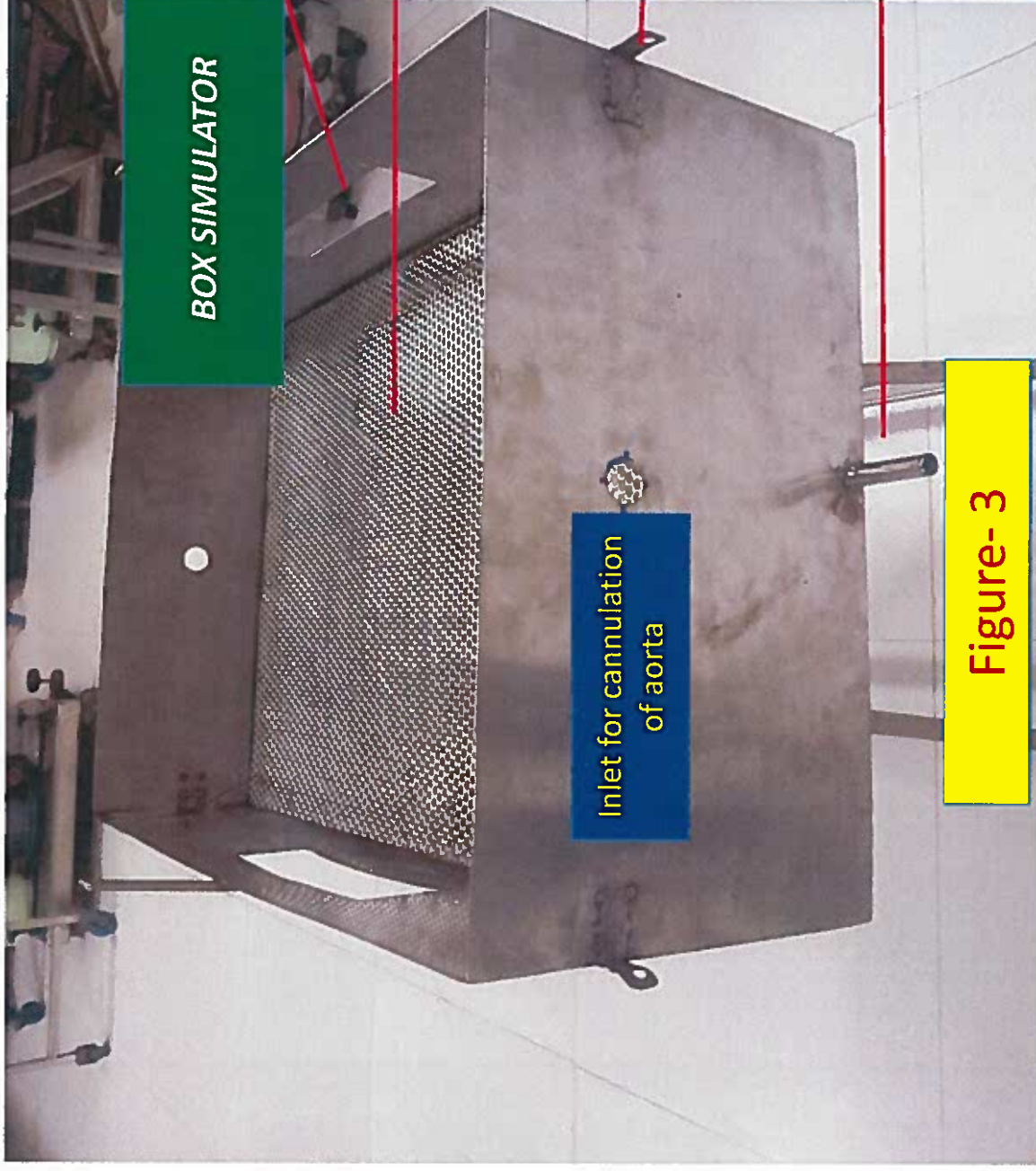
Aortic cannulation

Figure- 1



PULSATILE PERFUSION PUMP
(INDIGENOUSLY MADE AND
UTILIZED AT NADIAD)

Figure- 2



BOX SIMULATOR

**Inlet for cannulation
of aorta**

Entry point for cautery plate

**Perforated metal sheet for porcine
cadaver placement**

**Fixation hinge for rubber sheet
(latter serves as port entry points)**

Outlet for effluent

Figure- 3

BASIC INSTRUMENTATION USED



Figure- 4

DIFFICULT TO CANNULATE PORCINE URETER

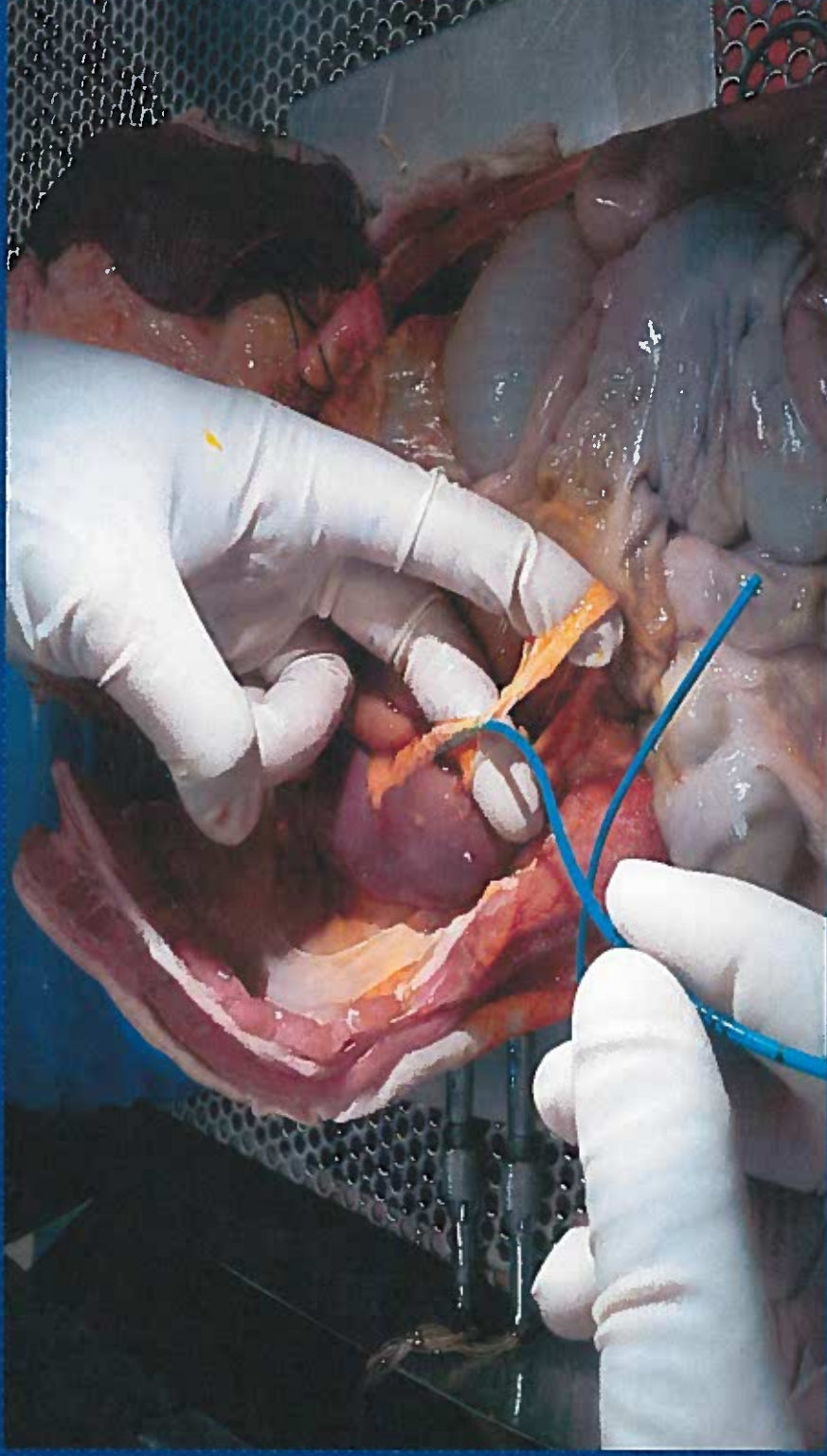
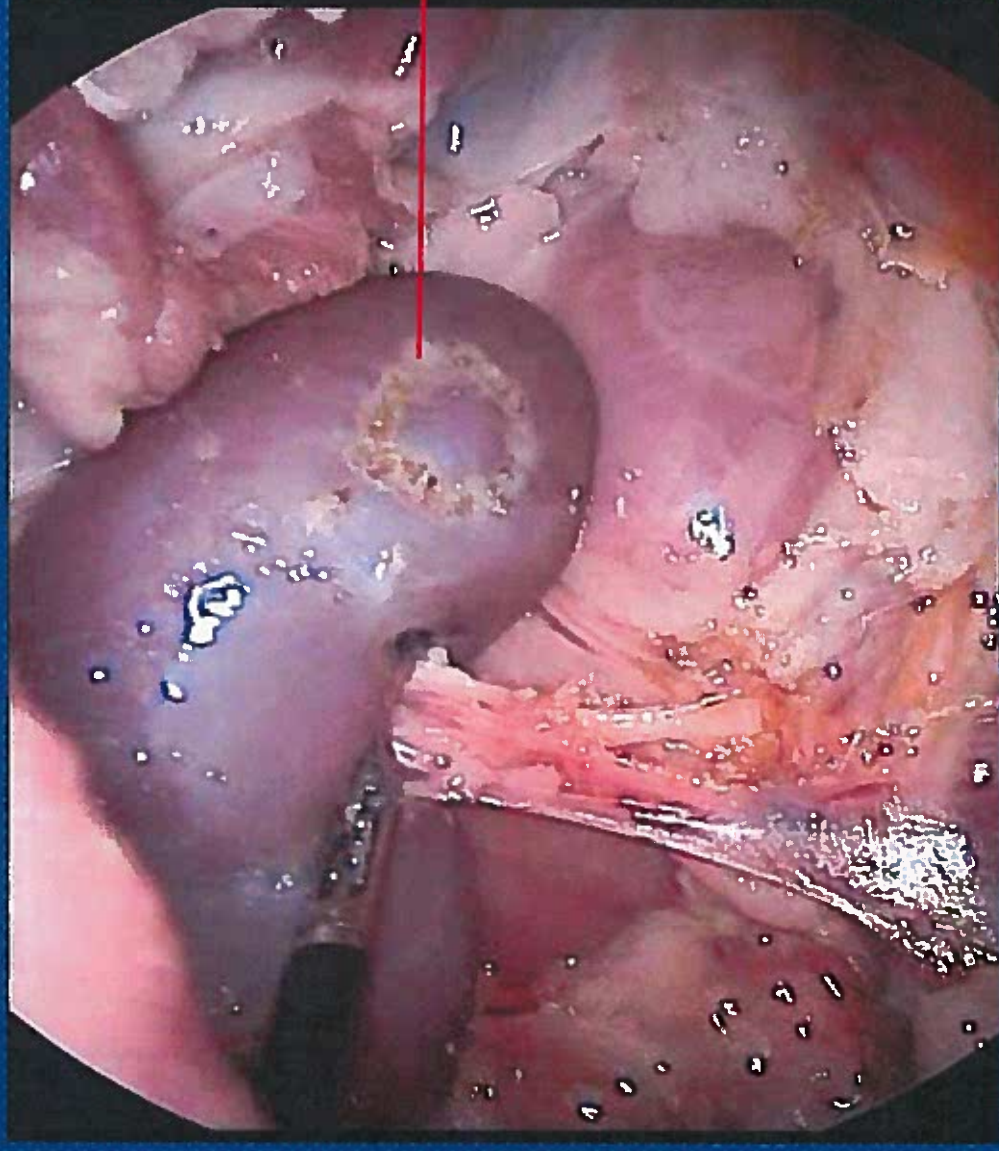


Figure- 5



TUMOR MARKING
SIMULATION- CIRCULAR
RIM OF KIDNEY SCORED
WITH ELECTRO CAUTERY

Figure- 6

PERFORMANCE OF SUBJECTS BEING EVALUATED BY THE SCORERS



Figure- 7