ABSTRACT BODY:

INTRODUCTION: We describe a case of living related pediatric liver transplant at the Narayana Hrudayalaya Institute of Medical Sciences in Bangalore, India with intraoperative consultation provided by physicians at the Children's Hospital of Philadelphia (CHOP) using teleconferencing.

The application of telemedicine to anesthesia [Tele-anesthesia] has been limited. It involves a connection between two institutions that enables a live video and audio feed with minimal delay to facilitate direct communication between the anesthesia teams.

Previous work by Cone et al. demonstrated the ability to direct an anesthetic in a remote location using satellite communication.(1,2) Our case is the first reported case using teleconferencing to direct a pediatric liver transplant.

RESULTS: A week prior to the scheduled surgery a connection was made with the remote facility to ensure equipment compatibility. At that time the lead consultant (MR) from CHOP presented a lecture on the management of pediatric patients for liver transplant using GoToMeeting software online(3). The equipment used in Bangalore consisted of a video camera, a video conference device by Polycom and an ISDN (Integrated Services Digital Network) line with 128 kb/s bandwidth. ISDN allows voice and data to be transmitted simultaneously across the world using end to end digital connectivity. We used the Karl Storz Endoscopy-America, Inc. “OR1” Operating Room Control system at CHOP. This system provides the ability to do video and audio conferencing using ISDN.

The patient was a 4 year old male with a history of extrahepatic biliary atresia who subsequently developed liver failure and presented for living related liver transplant. His pre-operative weight was 16 kg, positive findings on physical exam included ascites, a palpable liver edge and a large spleen.

After obtaining parental consent a connection was established with the remote location at 9:50 p.m. eastern standard time on the day of surgery. The most recent labs of the patient, the anesthetic and surgical plan were reviewed with the entire remote team and all questions addressed prior to induction of anesthesia. A camera was positioned in a manner allowing us to observe the surgical field and the patient monitors. Initial vitals and arterial blood gases are as noted in table 1. The patient underwent a inhaled induction with sevoflurane, two peripheral intravenous lines were placed, a left radial 22 gauge intra-arterial catheter and a right 5.5 French internal jugular vein catheter were placed. We provided real time feedback to the Bangalore team throughout the procedure, e.g. during the placement of the central access our team at CHOP was first to notice persistent ectopy and immediately instructed the remote team to withdraw the central catheter a few centimeters with immediate resolution. We recorded vital signs directly from the monitors, laboratory results were dictated to us verbally and we recorded this data using a Microsoft Excel spreadsheet. We provided guidance and recommendations to the anesthesia team including management of blood gases, administration of sodium bicarbonate, fluid management, management of coagulopathy, administration of pressors, and glucose management (see table 1). The
pre-anhepatic phase lasted about 7 hrs the anhepatic phase was about 1hr and the neohepatic phase was an additional 2hrs. The patient did well postoperatively and was extubated on the following day.

**DISCUSSION:** This is the first report of organ transplantation with the use of remote anesthesia consultation. Tele-anesthesia provides a means for expert consultation during a case. There are however several challenges, for example

1) **Medical License:** When one provides tele-anesthesia who becomes responsible for licensing? Is it the state where the consultant resides or is it the state or country in which the consultant provides care?

2) **Equipment function:** Our connection was disconnected during the first case because of a preset limit on connection time at the remote location. We reconnected without any difficulty or patient compromise. We recommend a simulated connection prior to the date of surgery to ensure equipment compatibility. We also suggest a backup communication system in the event of a disconnect, we used GoToMeeting online software as our backup.

3) **Issue of liability:** What procedures are available in the event of a negative outcome? Who and where does the plaintiff bring a suit? Would the consultant’s malpractice coverage be in effect during consultations in another country? In our case a document was drafted between the two institutions requiring the hospital in Bangalore India to take full responsibility for any claims made in the event of a malpractice claim.

4) **Payment issues:** We provided our services at no cost to the team or patient, however as tele-anesthesia expands one would expect that consultants will be reimbursed for their services.

5) **Time zone differences:** As was the case with our report, a consultant may have to provide consultation during evening and dawn hours. This could make it difficult for the consulting physician to provide services at his usual anesthetizing location on the day following a tele-anesthesia case.

6) Finally the ideal system for tele-anesthesia would comprise of a recording system that would instantaneously allow patient data to be displayed at both locations and would allow both teams full access to the ongoing patient record.

Future endeavours include having the entire consulting team operate remotely i.e. the surgeon would operate remotely using robotics in conjunction with teleanesthesia. The surgeon in our case was from Delaware, USA, robotic equipment would allow him to operate in the USA and potentially decrease the cost of providing the service.

**ISDN:** Integrated Services Digital Network, is a system of digital phone connections which has been available for over a decade.

Table 1
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<th>Time</th>
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<th>PCO₂</th>
<th>PO₂</th>
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<th>Hct</th>
<th>Gluc</th>
<th>K⁺</th>
<th>Ca²⁺</th>
<th>P</th>
<th>BP</th>
<th>Spo₂</th>
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<td>4</td>
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<td>31</td>
<td>93</td>
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<td>0.91</td>
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**REFERENCES:**