Basic Science (con't.)

EFFECTIVENESS OF FETOSCOPIC ELECTROCAUTERISATION IN DIFFERENT MEDIA: AIR, PERFLUOROCARBON, GLYCERIN, GLYCIN, ELECTROLYTE SOLUTION

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Background: Electrocauterisation during fetoscopic surgery is a challenge in the native, conductive, electrolyte-containing amniotic fluid. Conversely, intrauterine insufflation of carbon dioxide may cause lethal hypercapnia and acidosis in the fetus. Therefore, other media must be considered.

Objective: To evaluate the efficiency of electrocauterisation in air, perfluorocarbon, glycerine, glycine, and electrolyte solution in an in-vitro model, as these have been described as media in experimental fetoscopic surgery.

Methods: Using bipolar electrocautery, standardized lesions were made in 16 skin-cartilage specimens from the ears of New Zealand White rabbits in 4 different media: Air, 85% glycerine (GS), 1.5% glycin, electrolyte solution (ES, Na^{+} 140; K^{+} 5; Ca^{++} 2,5; Mg^{++} 1,5; Cl^{-} 153 mmol/l), and perfluorodecalin (PFD, a perfluorocarbon). The effectiveness of electrocauterisation in the different media was compared by calculating the mean necrosis indices (NI, quotient of native to necrosed tissue thickness) and assessing the qualitative histologic changes.

Results: Except for ES, all cauterized areas showed clear sequellae of electrocauterisation such as thinning, loss of tissue architecture, increased staining of the stroma, and kariorhexis. The mean NI were 1.38 (CI: 1.29-1.47) for air, 1.37 (CI: 1.27-1.47) for GS, 1.32 (CI: 1.23-1.41) for PFD, 1.31 (CI: 1.22-1.40) for glycin, and 1.05 (CI: 1.01-1.09) for ES. The mean NI was significantly lower for ES compared to all other media ($p < 0.01$). No significant differences were detected between the non-conductive substances.

Conclusion: Among the tested media air, glycin, glycerine, and perfluorodecalin allow similarly effective electrocauterisation. As expected, bipolar electrocauterisation in electrolyte solution is ineffective. Perfluorodecalin may have other potential advantages as a medium in endosurgery such as low surface tension, biologic inertia, optical clarity and insolubility of blood.

EASY KNOTTING TECHNIQUES

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Nightmare in laparoscopic reconstructive paediatric surgery is suturing and knotting. Certain easy knotting techniques were tried with good results.

Materials and Methods: The Techniques namely 1. Cycle "O" loop technique, 2. Tip to tip technique, and 3. Half step techniques are tried according to the situation. All laparoscopic procedures which needed knotting were tried with these techniques, and results evaluated by time taken for knotting, movements necessary to make a knot, the angles at which each knot can be made, type of suture material versus knotting technique were analysed. The finer aspects such as holding long thread, small thread position, long thread position before loop formation, position of dissector, position of long thread after loop formation, where to start for a loop formation to make reef knot, etc., were analysed and results were given.

Results: The following observations and results were obtained with each technique.

Technique. Suture material. Angle at which easily made. In which difficult situation this technique is more useful. The best advantage.

Tip to tip technique. Any material 90° between working ports. When suture material length is very small. Least movement.

Circle "O" Loop. Little stiff eg, Prolene, ethilon. Any angle. Where working ports are not in triangulation (or) close each other. Cumbersome loop formation and shipping while knotting can be avoided.

Half step technique. Any material 600 to 1200. Where repeated slippage while loop formation. Overcoming the difficulties in knotting is possible in C loop technique.

Conclusion: Certain problems in knotting in laparoscopy were studied and how to overcome such difficulties were found out. Bases on observations, certain innovative techniques and their applications are outlined. These techniques are useful in reconstructive paediatric laparoscopic surgery in terms of easy knotting and time saving.

EXPOSURE TO CARBON DIOXIDE AND HELIUM REDUCES IN VITRO PROLIFERATION OF PEDIATRIC TUMOR CELLS

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Background: We showed that CO2 used for pneumoperitoneum modulates the function of macrophages and polymorphnuclear cells via direct effects and acidification. In vitro and animal studies also confirmed an alteration of the behavior of adult tumor cells by CO2. The impact of CO2 and on the behavior of various pediatric tumors has not been determined.

Methods: Cell lines of neuroblastoma (IMR 32, SK-N-SH, Sy5y), lymphoma (Daudi), hepatoblastoma (Huh 6), hepatocellular carcinoma (Hep G2), and rhabdomyosarcoma (Te 671) were incubated for 2 hours. Incubation was performed with 100% CO2, 100% helium, and 5% CO2 as control. Cell proliferation was determined by the MTT-assay (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) which was performed before, after incubation, and daily for 4 days. Vitality of the cells was determined by trypan blue. The extracellular pH during incubation was measured every 10 minutes.

Results: CO2 for 2 hours significantly decreased the proliferation of neuroblastoma, lymphoma, hepatoblastoma and hepatocellular carcinoma cells. This decrease persisted over 4 days in neuroblastoma, lymphoma and hepatocellular carcinoma cells. CO2 had no impact on hepatoblastoma and rhabdomyosarcoma cells. Helium had a similar effect on neuroblastoma cells. After 4 days, a significant decrease of cell activity was found in 2 neuroblastoma cell lines and in hepatoblastoma cells. Helium had no effect on lymphoma and hepatocellular carcinoma cells. The extracellular pH was 6.2 during incubation with CO2 and 7.6 during incubation with helium.

Conclusion: CO2 and helium may affect the proliferation of some pediatric tumor cell lines in vitro. However, some of these effects and the impact on the extracellular pH are differential. The role of pH modulation, hypoxia and direct effects of gases remain to be investigated.

IMPROVING TACTILE SENSATION IN MINIMALLY INVASIVE PEDIATRIC SURGERY

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Purpose: The goal of this project was to investigate factors that impact tactile sensation during minimally invasive pediatric surgery.

Methods: 3 different 3 mm Maryland laparoscopic instruments were tested with and without the resistance of a trocar (Ethicon 3 mm); Jarit (24 cm shaft, 113 grams), Storz (30 cm shaft, 62 grams), and an ultra-light prototype (24 cm shaft, 5 grams). A laparoscopic simulator was constructed that provided no visual clues forcing the surgeon to rely on tactile sensation only. Instruments were guided by fixed shafts at three different angles of inclination (5, 45, and 90 degrees) toward the experimental target. Surgeons were instructed make contact with the target with as little force as possible. Instantaneous pressure measurements on the target were measured and recorded every 0.00001 sec. Differences between impact pressures were compared with student t-test.

Results: 27 surgeons in the study. 18 attendings, and 9 surgical residents(>pgy3). 16 of the participating surgeons considered themselves advanced minimally invasive surgeons. 5 of the surgeons were Pediatric Surgeons. There were no statistically significant differences between the impact pressures using the Storz and Jarit instruments. The ultra-light had significantly lower impact pressures than the Storz instrument at all angles both with a trocar ($p < 0.05$) and without a trocar ($p < 0.001$). The ultra-light had lower impact pressures than the Jarit instrument at all angles in the absence of the trocar ($p < 0.001$), but with a trocar in place the only significant difference was at 5 degrees ($p < 0.001$). The trocar had a negative impact on tactile sensation with the ultra-light ($p < 0.01$).

Conclusions: The two fold difference in mass between the Storz and Jarit instruments did not make an impact on tactile sensation in this model. Decreasing instrument mass by 10 to 20 fold did make a statistically significant improvement in tactile sensation.

Mean Impact Pressure on Target

	Jarit + Trocar	Storz + Trocar	Ultralight + Trocar	Jarit	Storz	Ultralight
90°	1.08 cmH2O	1.09 cmH2O	1.39 cmH2O	1.41 cmH2O	**.46 CMHDO**	**0.82 CMH2O**
45°	1.78 cmH2O	1.81 cmH2O	1.60 cmH2O	1.73 cmH2O	**.61 CMHDO**	**0.97 CMH2O**
5°	0.84 cmH2O	1.07 cmH2O	0.64 cmH2O	0.86 cmH2O	**.97 CMHDO**	**0.57 CMH2O**