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The Bulletin of the Hong Kong College of Anaesthesiologists

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Multi-Regional Ropivacaine Instillation During Laparoscopic Cholecystectomy

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SUMMARY

This study evaluated the effect of intraperitoneal and incisional injection of ropivacaine on postoperative abdominal and shoulder pain in Chinese patients after laparoscopic cholecystectomy. Thirty healthy patients aged between 21 and 65 years undergoing elective laparoscopic cholecystectomy were randomly assigned to one of two treatment groups. At the end of the operation, 20 ml of the test solution was injected under direct vision into the hepato-diaphragmatic space and gallbladder bed, and another 10 ml of the solution infiltrated around the peri-portal area. The solutions used were 0.5% ropivacaine in the treatment group, and 0.9% normal saline in the control group. Postoperative analgesia was achieved by patient-controlled morphine infusion. Postoperative abdominal pain was assessed using a visual analogue scale at 0.5, 1, 2, 4, 8, 12 and 24 hours. Shoulder pain was assessed using a five-point verbal rating scale at the same time intervals. Patients in the treatment group had lower abdominal pain scores in the first hour after the operation. The mean time to first request for morphine was also increased from 34 to 132 min. The hourly morphine consumption was significantly less in the treatment group in the first 4 hours ($P < 0.05$). However, there were no significant differences in the incidence and severity of shoulder pain between groups. There were also no difference in the overall incidence of side effects and recovery characteristics. A combination of intraperitonal and incisional injection of 150 mg ropivacaine is safe, and effective in reducing early abdominal pain and opioid consumption after laparoscopic cholecystectomy.

Keywords: Local anesthetic; Laparoscopic cholecystectomy; Morphine; Postoperative pain; Patient controlled analgesia; Ropivacaine; Wound instillation

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Early postoperative pain is the most important complaint after elective laparoscopic cholecystectomy. During the first 24 hours, the most painful wounds are located at the right upper quadrant and the port-site. Pain is also referred to the shoulder, but tends to be mild in the early postoperative period, and only becomes significant in the subsequent eight hours.[1-2]

Numerous methods have been used to prevent postoperative pain. Intraperitoneal and incisional injection of local anesthetic is one of effective techniques and has been investigated in several interventional trials.[3-20] While most of

these studies use bupivacaine, ropivacaine was only used in one study.[17] Compared with bupivacaine, ropivacaine is a longer acting amide that has the advantage of producing less cardiotoxicity and neurotoxicity.

Although the use of local anesthetic instillation has been widely studied in the Caucasian population, there are no data in Chinese. Our study therefore designed to assess the effects of intraperitoneal and incisional injection of ropivacaine on postoperative abdominal and shoulder pain after elective laparoscopic cholecystectomy in Chinese population.

Materials and Methods

Approval from the local clinical research ethics committee and informed consent of all patients were obtained. Thirty-five Chinese patients of American Society of Anesthesiologists physical status class I or II, aged between 21 and 65 years, scheduled for elective laparoscopic cholecystectomy were included in the study. Patients were excluded if they suffered from chronic pain other than gallstone disease, had received opioid for more than one week before surgery, were allergic to local anesthetics, had acute cholecystitis, had the surgery converted to an open procedure, or developed postoperative complications which would increase postoperative pain.

All patients received a standard anesthetic technique. No sedative premedication was prescribed. General anesthesia was induced with fentanyl 2 μg/kg IVI, thiopentone 4 mg/kg IVI. Atracurium 0.5 mg/kg was given to facilitate tracheal intubation. Anesthesia was maintained with isoflurane 0.5-1.5% delivered with a 30% oxygen and air mixture. Intermittent doses of atracurium were administered to maintain muscle relaxation. Minute ventilation was controlled and adjusted to keep the end-tidal carbon dioxide concentration between 30-40 mmHg.

Surgery was performed by the same group of surgeons using a standard four-port technique. Carbon dioxide was used for peritoneal insufflation, and the intraperitoneum pressure was kept below 15 mmHg. At the end of the operation, carbon dioxide was expelled as much as possible from the principal trocar. A surgical difficulty score (0-10) for each patient was also rated by the chief surgeon. This score was based on the presence of intraabdominal adhesions, difficult gallbladder anatomy, gallbladder perforation, bleeding during surgery, or enlargement of the umbilical site for the extraction of the gallbladder.

Towards the end of surgery, patients were randomly allocated to one of the two groups concealed by envelopes. Patients in the treatment group received ropivacaine 0.5%, patients in the control group received normal saline. The solution was prepared in a double-blinded fashion. Ten ml of the solution was instilled under direct vision into the hepato-diaphragmatic space, and 10 ml into the gallbladder bed. Thereafter patients were kept in a 20° head-down tilt for 15 minutes. Before skin closure another 10 ml of the tested solution was infiltrated around the peri-portal area (4 ml at the umbilical site and 2 ml at each of the three trocar sites).

Residual muscle paralysis was antagonized by neostigmine and atropine. The time from intubation to extubation was recorded as "anesthesia time", and the duration of pneumoperitonuem was recorded as "operation time".

Postoperative analgesia was provided by a patient controlled analgesia (PCA) machine delivering intravenous morphine 2 mg bolus at 5 minute lockout. Postoperative nausea and vomiting was treated with intravenous metaclopramide 10 mg every 4 hours as necessary.

Patients were assessed by the ward staffs that were blinded to the group allocation at 0.5, 1, 2, 4, 6, 8, 12 and 24 hours after surgery. Postoperative abdominal pain was assessed

using a 100 mm visual analogue scale (no pain = 0 and maximal pain = 100). Shoulder pain was assessed at rest using a five-point verbal rating scale: no pain = 0; discomfort, but no pain = 1; light pain = 2; moderate pain = 3 and severe pain = 4. Abdominal pain was defined as wound pain or pain located inside the abdomen. Shoulder pain was rated as a sensation of discomfort or pain in the shoulders.

Other parameters assessed at the same time intervals included side effects of nausea, vomiting, dizziness, tinnitus and circumoral numbness. Four-point verbal rating scores were used to rate nausea and vomiting: none = 0; nausea only =1; nausea and vomiting = 2 and repeated vomiting = 3. The time interval from extubation to the first request for morphine, unassisted ambulation and hospital discharge were also noted.

Sample size was estimated to detect a 50% difference in the total morphine consumption after surgery. We calculated that 15 patients per group will achieve a power of 80% at type I error of 0.05. Parametric data was analyzed using Student's *t*-test and non-parametric data was analyzed using the χ^2 test. For some of the relevant variables such as pain scores and morphine consumption, multi-factorial analysis of variance with repeated measures was performed and followed by Student's *t* test for intergroup comparison. Results were considered as statistically significant at 5% critical level.

Results

A total of 35 patients entered the study, but five were excluded, leaving fifteen patients in each study group. Among the five patients that were excluded, one had surgery converted to an open procedure because of common bile duct injury. One patient required drainage of the sub-hepatic space. Another patient developed an umbilical hematoma that required re-operation. Two patients had incidental findings of umbilical hernias that required additional surgical repair.

The two groups of patients were compare-

Table 1: Demographic, operative and anesthetic data.

	Ropivacaine (n = 15)	Control (n = 15)
Demographic data		
Gender (Female : Male)	10 : 5	10 : 5
Age	48.7 ± 11.1	48.5 ± 10.3
Body mass index (kg/m^2)	24.1 ± 2.3	24.8 ± 3.3
ASA status (I : II)	10:5	12:3
Operative data		
Duration of surgery (min)	38.8 ± 12.5	43.1 ± 14.6
Surgical difficult score	3.2 ± 1.9	3.9 ± 1.9
Bile spillage (no. of patients)	5	4
Anesthetic data		
Fentanyl (ug)	122.8 ± 15.2	126.5 ± 17.2
Thiopentone (mg)	247.5 ± 37.3	250.2 ± 34.7
Atracurium (mg)	37.0 ± 5.0	39.9 ± 8.9
Crystalloid infusion (ml)	760.0 ± 304.3	881.3 ± 377.3
Duration of anesthesia (min)	63.9 ± 14.6	68.9 ± 15.7

Values are mean ± SD or number of patients.

able in demographic characteristics, operative and anesthetic data (Table 1). The VAS scores for abdominal pain were significantly lower in the ropivacaine group than in the control group in the first hour after the operation (Figure 1). The mean time to first request for morphine was also increased from 33.5 minutes in the control group to 131.9 minutes in the ropivacaine group ($P < 0.05$, Student's t test). The hourly morphine consumption was significantly less in the ropivacaine group during the first 4 hours (Figure 2). Total morphine consumption at 24 hours was also significantly less in the ropivacaine group (Figure 3).

The incidence and severity of shoulder pain however, was not significantly different between groups (Table 2). There were no significant differences in the overall incidence of side effects between groups (Table 3) and in the time to unassisted ambulation or hospital discharge (Table 4).

Table 2: Postoperative shoulder pain.

Score	Degree of pain	Ropivacaine (n = 15)	Control (n = 15)
0	No pain	13	12
1	Discomfort, but no pain	0	1
2	Light pain	2	2
3	Moderate pain	0	0
4	Severe pain	0	0

Values are number of patients with shoulder pain during the first 24 hours.

Table 3: Side effect profile.

	Ropivacaine (n = 15)	Control (n = 15)
Nausea score in the first postoperative 4 h	1 (0-5)	0 (0-4)
Nausea score in postoperative 4-24 h	0 (0-4)	0 (0-8)
Metochlorpramide in 24 h (mg)	0 (0-20)	0 (0-20)
Dizziness in 24 h	6	8
Tinnitus in 24 h	0	0
Circumoral numbness in 24 h	0	0

Values are median (range) or number of patients.

Table 4: Recovery characteristics.

	Ropivacaine (n = 17)	Placebo (n = 17)
Time to ambulation (hours)	19.7 ± 2.9	18.7 ± 2.1
Time to hospital discharge (hours)	42.1 ± 11.5	52.8 ± 25.5

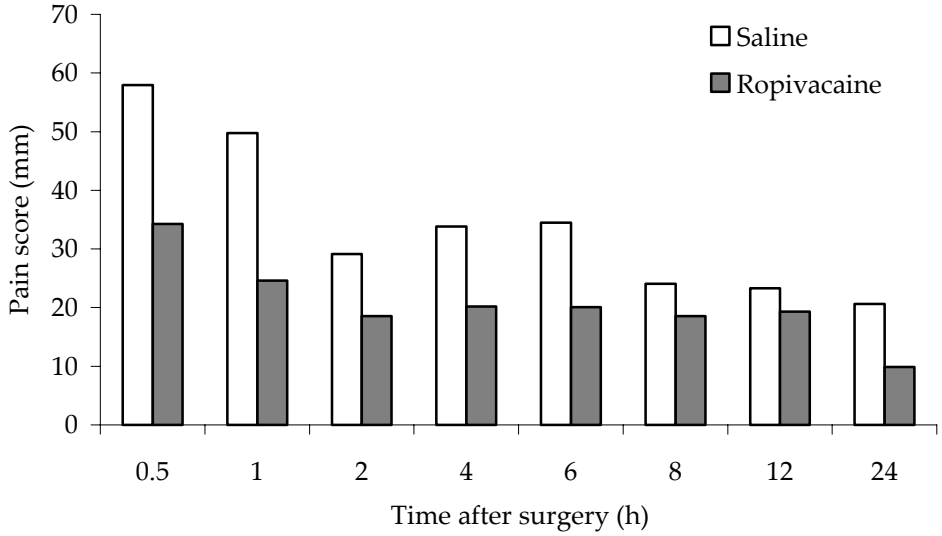
Values are mean ± SD.

Discussion

The origin of pain after laparoscopic cholecystectomy is multifactorial. Pain may arise from pneumoperitoneum, the port-wounds, and cholecystectomy itself.[1] Abdominal pain accounts for most of the pain experienced in the first 24 hours, with parietal pain being less severe than visceral pain.[2] Some patients may also experience shoulder tip pain. The analgesic effect of local anesthetic given either as an intraperitoneal instillation,[2-15] or as a local wound infiltration[18-20] or both [17] has been studied extensively.

Local wound infiltration produced significant analgesia in two of the three studies.[18-19] The effect of intraperitonal instillation, however was conflicting. Six studies demonstrated no benefit in pain relef.[2-7] These studies used a lower concentration of bupivacaine as opposed to the eight studies that reported effective pain relief.[8-15] It may be therefore, necessary to administer a sufficient amount of drug onto the site of tissue injury in order to demonstrate any analgesic effect. However, the maximum dose of bupivacaine is limited by its toxicity. Current pharmcokinetic data only support the safe use of bupivacaine up to 2.5 mg/kg. Thus when intraperitoneal instillation is combined with local wound infiltration to achieve satisfactory

Figure 1. Abdominal pain after laparoscopic cholecystectomy.
Data are presented as mean. Pain scores were significantly lower in the ropivacaine group in the first hour ($P < 0.05$).



anagelsia, the dose of bupivacaine required may exceed the safety limit.

Ropivacaine is less toxic than bupivacaine. The use of a larger dose of ropivacaine is probably safe. In our study, a combined dose of 150 mg ropivacaine was used with none of our patients reporting symptom of systemic toxicity. A dose of 286 mg had also been shown to be safe in the study conducted by Bisgarrd *et al*.[17] The recommended dose for ropivacaine in field blocks and local infiltration by manufacturer is 5-200 mg. Similar data for intraperitoneal administration however are not available. Future pharmacokinetic studies of ropivacaine after the combined routes of administration could be useful in establishing a safe and effective dose.

The incidence of shoulder pain after laparocopic cholecytectomy was reported to be 30-40%.[21] In our study, the incidence of shoulder pain was 20% and 13.3% in the control and study groups, repectively. Intraperitoneal local

Figure 2. Hourly morphine consumption. Values are mean ± SEM.

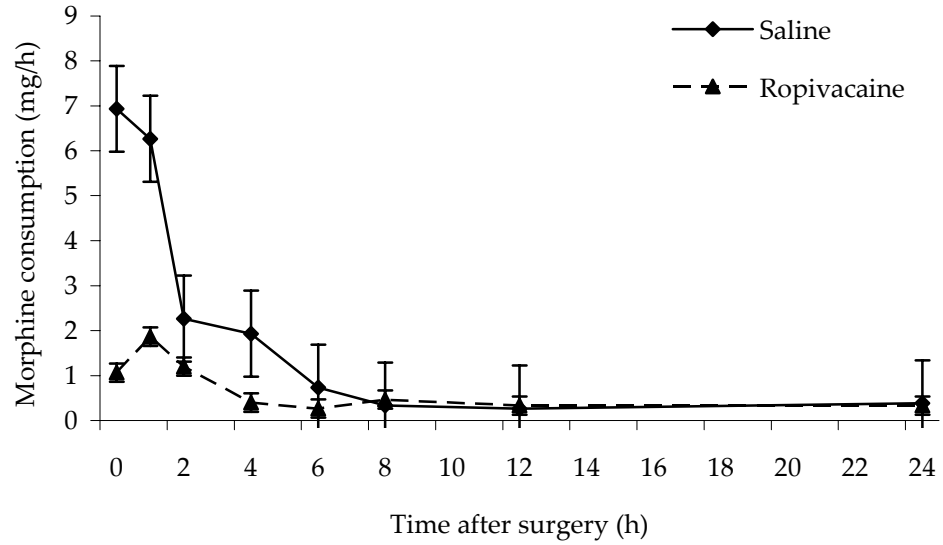
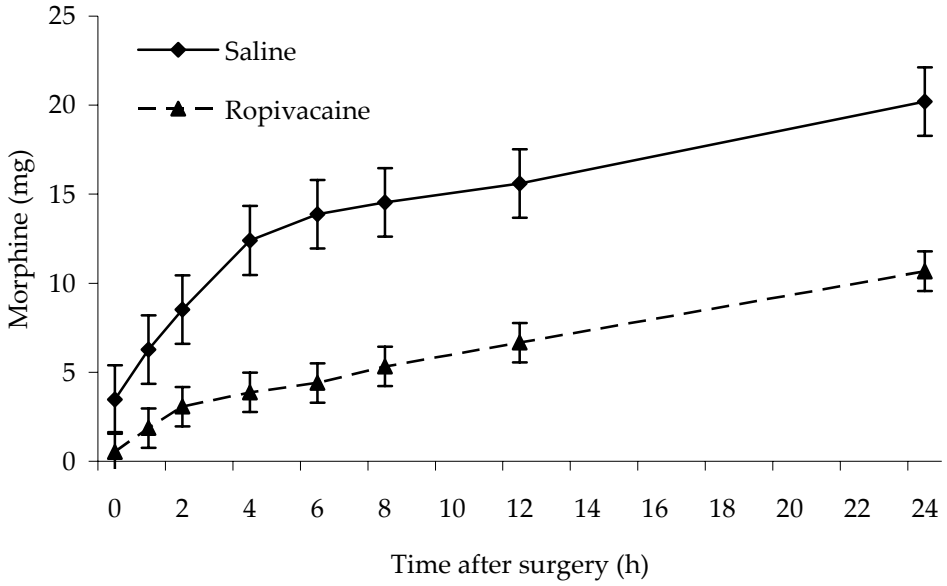


Figure 3. Cumulative morphine consumption. Values are mean ± SEM.



anesthetic instillation was reported useful in reducing shoulder pain in a number of studies.[16,22] This is contrary to our study. There is possibly due to insufficient power because of the incidence of shoulder pain in our population was low.

Laparoscopic cholecystectomy is a painful procedure. The incidence of severe abdominal pain (VAS > 50) in the early postoperative period in our control group was 60%. This was comparable to studies in Caucasian populations in which an incidence of 30-70% was reported.[23] Marked inter-individual variability of pain could also be noticed among our patients, thus confirming the findings by Joris *et al*.[2] Two patients from the saline group reported absence of pain (VAS = 0) in the immediate post-operative period, while two stated their pain as severe (VAS = 100). The reasons for this variability were unclear. The same group of surgeons performed all the procedures employing the same technique. No correlation could be detected between the pain intensity and the surgical difficulty score.

Pain, as a subjective sensation, and is experienced in the context of cultural learning. It has been reported that Chinese have a higher threshold for pain and require less postoperative analgesia compared with the Caucasians.[24,25] However, more recent studies showed no ethnic difference.[26,27] The incidence of severe abdominal pain in our study also did not differ from that reported in the studies on Caucasian patients.[23]

In summary, the combination of intra-peritoneal and incisional injection of 150 mg ropivacaine is effective in reducing early abdominal pain and opioid consumption in Chinese patients after elective laparoscopic cholecystectomy.

Acknowledgements

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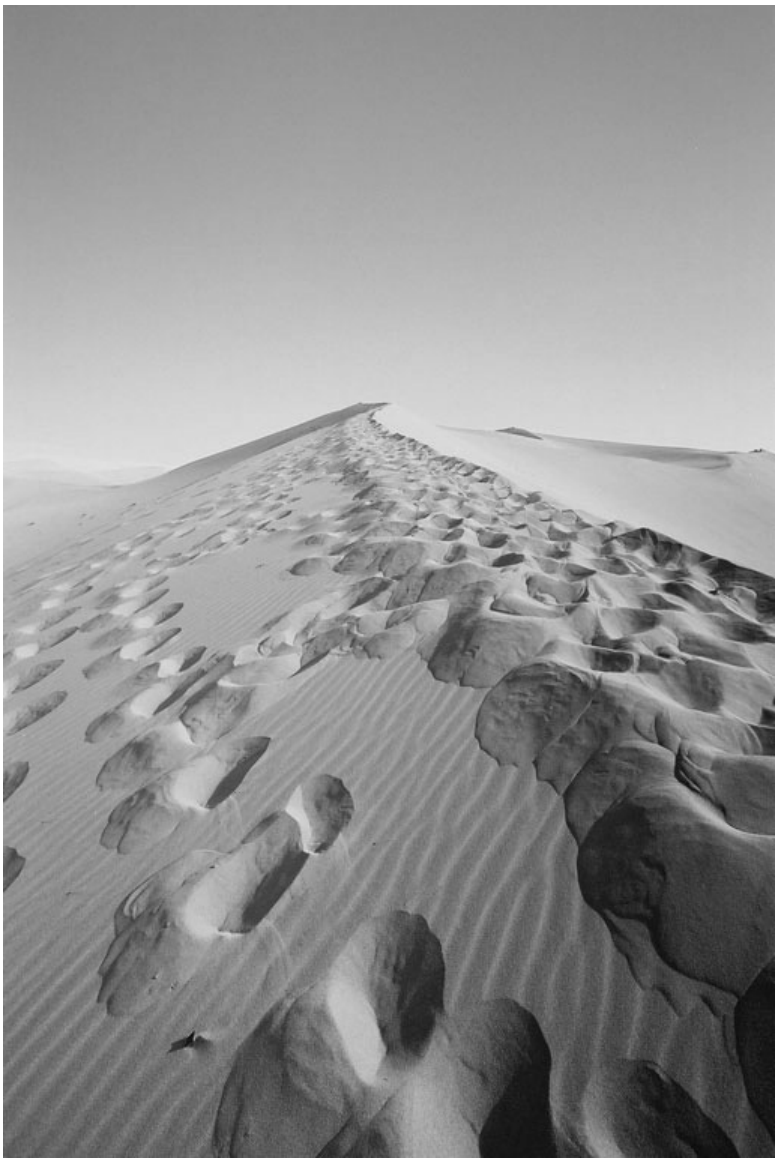

Double-blind, Randomized Comparison of Ondansetron and Propofol to Prevent Postoperative Nausea and Vomiting

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SUMMARY

Propofol induction and prophylactic ondansetron reduce the incidence of postoperative nausea and vomiting (PONV). To date no comparison of these two techniques has been reported. We compared their efficacy for prevention of PONV after minor gynecological laparoscopy. With ethics committee approval and patient consent, 200 women undergoing gynecological laparoscopy were allocated randomly to two groups. In the ondansetron group, patients received ondansetron 4 mg immediately before thiopentone 4 mg/kg. In the propofol group, anesthesia was induced with propofol 2 mg/kg. Both groups also received fentanyl 2 μg/kg and atracurium 0.5 mg/kg before tracheal intubation. Anesthesia was maintained with isoflurane 0.5% and nitrous oxide 70% in oxygen. Ketorolac 30 mg was given after surgery for analgesia. Postoperative PONV episodes, severity of pain and sedation were recorded for 48 hours. Demographic and operative details were similar between groups. In the ondansetron group, the median pain score (2/10) during the first hour was similar to that of the propofol group (3/10), and the sedation scores were identical. The incidence of PONV for the period 0-1 h, 1-4 h and 0-48 h after surgery for the ondansetron and propofol groups were 24%, 7%, 30% and 19%, 12%, 26%, respectively and there were no significant difference between the two groups. Given an PONV incidence of 73% after thiopentone, fentanyl, isoflurane and nitrous oxide anesthesia, the number-needed-to-treat (95% confidence intervals) to prevent PONV in the ondansetron group, 2.4 (2.2-2.5) was also similar to that in the propofol group, 2.2 (2.0-2.3).

Keywords: Postoperative nausea and vomiting; Anesthetic complications; Gynecologic laparoscopy; Antiemetic: ondnasetron, propofol

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Postoperative nausea and vomiting (PONV) are common problems after anesthesia.[1-4] Prophylactic administration of ondansetron, a selective 5-HT_3 antagonist, has been shown to decrease the incidence of PONV from 70% to 25%.[5-8] Another approach to the problem is to use a different anesthetic technique. Propofol as an induction agent has been shown to decrease the incidence of PONV to less than 45%.[9,10] However, there is no direct comparison between prophylactic ondansetron and propofol induction to prevent PONV. The aim of this

study was to compare the antiemetic efficacy of prophylactic ondansetron and propofol induction for preventing PONV after minor gynecologic laparoscopy.

Materials and Methods

The study was approved by the Clinical Research Ethics Committee. A double-blind randomized study was carried out in 200 Chinese women undergoing minor gynecological laparoscopy. All patients were classified as American Society of Anesthesiologists physical status 1 or 2. Patients were excluded if they had pre-existing nausea or vomiting or had received opioids or antiemetic within 24 hours prior to operation. Pregnant patients and patients with a history of gastro-oesophageal reflux were also excluded. Informed consents were obtained from all patients.

During the preoperative visit, patients were asked for any history of PONV, motion sickness and the day of the current menstrual cycle. Patients were fasted from midnight before surgery and no premedication was given. In the operating theatre, standard monitoring was applied and intravenous normal saline 100 ml/h was given. Patients were then randomly allocated into two groups to receive either prophylactic ondansetron or propofol induction.

In the ondansetron group, patients received intravenous ondansetron 4 mg immediately before thiopentone 4 mg/kg for induction of anesthesia. In the propofol group, patients received propofol 2 mg/kg for induction of anesthesia. All patients also received fentanyl 2 μg/kg and atracurium 0.5 mg/kg to facilitate endotracheal intubation. Anesthesia was then maintained with isoflurane 0.5% and nitrous oxide 70% in oxygen.

At the end of surgery, nitrous oxide and isoflurane were discontinued, the total anesthetic time was recorded and neostigmine 2.5 mg and atropine 1.2 mg was given to antagonize residual neuromuscular block. The subsequent time taken until the patient responded to verbal command was recorded as the recovery time.

After surgery, patients were assessed on arrival to the recovery room and then at 0.5, 1, 2, 4, 24 and 48 hours. Patients were discharged to ward after their recovery room stay for 1 hour. Incidences of emetic (vomiting and retching) and nausea episodes were recorded. Vomiting and retching separated by one minute were considered as separate episodes. Severity of pain and nausea were recorded on an 11 points verbal numeric scale, while sedation was recorded on a 5 points scale (1 = alert; 2 = asleep but alert after arousal; 3 = asleep and drowsy after arousal; 4 = asleep and difficult to rouse; 5 = unarousable). Rescue antiemetic was given as intramuscular prochlorperazine 12.5 mg when there were two or more emetic episodes, nausea persisted for more than 10 minutes, or upon patients' request. Postoperative analgesia was provided initially by intravenous ketorolac 30 mg and then intravenous pethidine 25 mg as required.

Table 1: Patient characteristics.

	Ondansetron (n = 100)	Propofol (n = 100)
Age (yr)	34 ± 5	33 ± 5
Height (cm)	160 ± 6	157 ± 5
Weight (kg)	56 ± 8	55 ± 9
Anaesthesia time (min)	22 ± 7	21 ± 5
Recovery time (min)	4 ± 2	3 ± 1
Previous PONV (%)	15	15
History of motion sickness (%)	20	21

PONV = postoperative nausea and vomiting

Statistics

Categorical data were analyzed by Fisher Exact test and continuous data were analyzed by Mann-Whitney U test. Incidence of vomiting and nausea, and the combined incidence of PONV were compared between the two groups at five different time intervals after surgery: 0-1 h (time in the recovery room), 1-4 h (the first three hours after patients returned to the ward), 4-24 h, 0-24 h and 0-48 h. The three scores obtained in the recovery (arrival, 0.5 and 1 h) for nausea, pain and sedation were summed for comparison between groups. The number-needed-to-treat (NNT) for the prevention of vomiting, nausea and PONV were calculated to indicate the clinical significance. $P < 0.05$ was considered significant.

Results

Demographic and anesthetic data were similar between groups (Table 1). Laparoscopic sterilization was performed on 57 patients in the ondansetron group and 44 patients in the propofol group. The remaining patients had diagnostic laparoscopies.

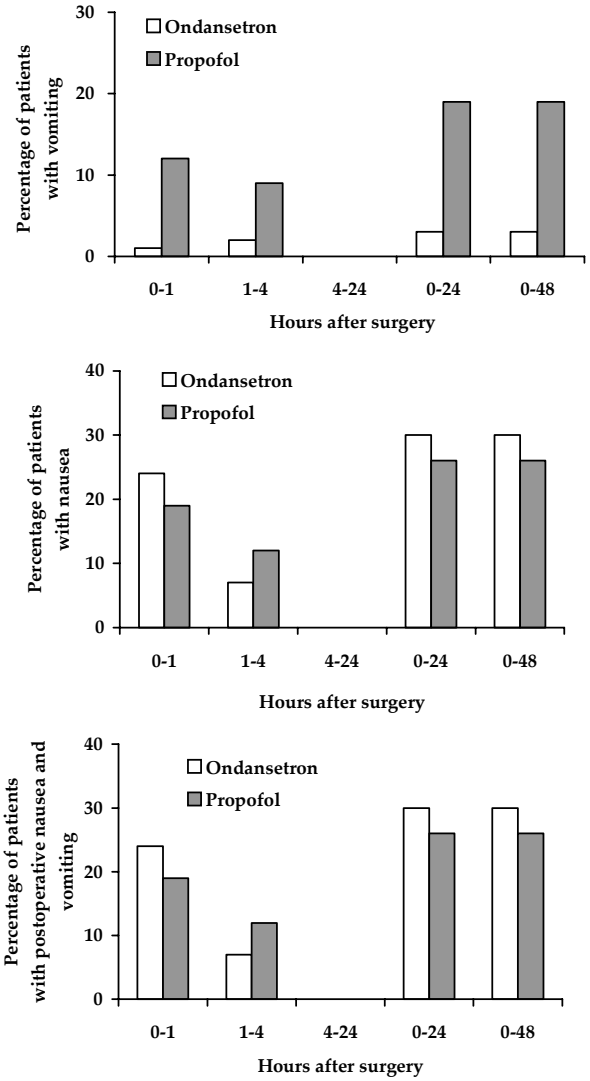
For each time period after surgery, more patients in the propofol group vomited compared with the ondansetron group (Figure 1, $P < 0.05$). No patient in either group vomited from the fourth hour after surgery. The incidence of vomiting after surgery was 3 % in the ondansetron group and 19 % in the propofol group.

In contrast, the incidence of nausea or vomiting in the ondansetron group (30%) was not different from that of the propofol group (26%) (Figure 1). All nausea episodes occurred within four hours after surgery.

In the ondansetron group, the median pain score at one hour after surgery [2, (range 0 - 10)] was similar to that in the propofol group [(3, range 0 - 10)]. Similarly, the median (range) summed nausea score, sedation score and pain score in the ondansetron group, 0 (0 - 19), 7 (5 - 11) and 10 (0 - 30), respectively, was not different from the propofol group, 0 (0 - 17), 6 (5 - 9) and 10 (0 - 22), respectively.

There was no statistical significant difference between groups in terms of rescue antiemetic or analgesic consumption. Nine patients in the ondansetron group received one dose of rescue antiemetic and one patient received two doses. Ten patients in the propofol

Figure 1. Percentage of patients with vomiting, nausea or postoperative nausea and vomiting after surgery. $n = 100$ in each group.



group received one dose of rescue antiemetic. Twenty-six patients in the ondansetron group received intravenous ketorolac 30 mg for analgesia and nine of them needed one dose of intravenous pethidine 25 mg. Twenty-seven patients in the propofol group received ketorolac and nine of them subsequently received one dose of pethidine.

Using the "control" incidence of PONV found by Suen *et al*,[5] the NNT (95% confidence intervals, CI) for ondansetron and propofol to prevent PONV was 2.37 (2.24 - 2.50) and 2.16 (2.04 - 2.28), respectively. To prevent nausea, the respective NNT was 3.57 (3.44 - 3.70) and 3.13 (3.00 - 3.26) for the two groups. To prevent vomiting, the NNT was 1.89 (1.79 - 1.99) and 2.70 (2.58 - 2.82) respectively. Both ondansetron and propofol appeared to be clinically useful for the prevention of PONV, nausea or vomiting. Ondansetron appeared to be superior for prevention of vomiting.

Discussion

The incidence of PONV was similar in the ondansetron group (30%) and the propofol group (26%). Compared with our previous data in 102 Oriental women underwent minor gynecological laparoscopy receiving thiopentone, fentanyl, atracurium, nitrous oxide and isoflurane for anesthesia (incidence of PONV = 73%),[5] both prophylactic ondansetron or propofol induction significantly reduce the incidence of PONV.

Ondansetron and propofol prevented vomiting but failed to improve nausea. Our results showed that nausea is more difficult to prevent than vomiting. It has been suggested recently that nausea and vomiting after anesthesia may be mediated by different mechanisms.[11] Given the diverse mechanism of nausea and vomiting, it is possible that a higher dose of propofol or ondansetron is required to prevent nausea

Ondansetron is a known selective 5-HT_3 antagonist and its mechanism is specific. But the mechanism through which propofol exerts its antiemetic effect is still unclear. It may be related to anti-dopaminergic effect, anti-serotonergic effect, or interaction with GABA system.[12-14]

We showed that propofol induction is as effective as prophylactic ondansetron for prevention of PONV and ondansetron is superior for prevention of vomiting. However, even with the use of prophylactic ondansetron or propofol induction, there were still more than 20% of patients experienced PONV. It is probable that using propofol induction and maintenance, avoiding nitrous oxide intraoperatively, and using antiemetics with different mechanism of action, PONV may be abolished in difficult cases.

In conclusion, prophylactic intravenous ondansetron 4 mg and propofol induction are equally effective in preventing PONV after minor gynecological laparoscopy.

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"The Sunshine Project": Ambulatory Laparoscopic Cholecystectomy

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SUMMARY

We surveyed a total of 136 patients undergoing ambulatory laparoscopic cholecystectomy at the Tuen Mun Hospital between October 1, 2003 and October 30, 2004. We compared the rate of same day discharge with that reported in the literature. We also recorded the severity of wound pain, postoperative nausea and vomiting and patient satisfaction. The discharge rate in our study was 91%. Patients indicated a high level of satisfaction with the procedure and postoperative nausea and vomiting was not found to be a serious problem. Pain management, however, could be improved as a number of patients suffered from acute pain in the phase II recovery.

Keywords: Anesthetic complications: Pain, Postoperative nausea and vomiting; Patient satisfaction; Laparoscopic cholecystectomy; Ambulatory surgery.

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Ambulatory surgery has been developed over a century and is now widely practiced and accepted in the western countries, owing to financial constraints and patient preference.[1-3] Extensive studies and surveys have been performed on ambulatory surgery to evaluate its efficacy, safety, cost effectiveness and patient satisfaction.[4-15]

Laparoscopic cholecystectomy has been widely practiced in Hong Kong since 1990.[16] However, ambulatory laparoscopic cholecystectomy is still an uncommon procedure. There were 2,234 laparoscopic cholecystectomy performed within the Hospital Authority in 2002, The average hospital stay was 4 days, posing a heavy burden on most surgical units. Among these cases, only approximately 3% (or 65 cases) were done as ambulatory laparoscopic cholecystectomy.

We initiated the "Sunshine Project" to establish ambulatory laparoscopic cholecystectomy service in the Tuen Mun Hospital, a territory referral hospital in the New Territories West cluster. This was named because patients scheduled for this procedure were to be

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admitted to the hospital after sunrise and to return home before sunset on the same day.

The aim of the present study was to survey the rate of same day discharge in ambulatory laparoscopic cholecystectomy. We also compared our performance with published reports locally and overseas.[17-25] The secondary endpoints were pain score, patient satisfaction, severity and frequency of postoperative nausea and vomiting. The rate and reason for unplanned admission were also recorded.

Materials and Methods

This survey was conducted from October 1, 2003 to October 30, 2004. Consecutive patients with the operation done in this period were recruited. A complete database of laparoscopic cholecystectomy including patient characteristics, details of surgery, duration and indication for operation were established as part of the protocol for the service.

Inclusion and exclusion criteria for ambulatory laparoscopic cholecystectomy are clearly outlined and patients were selected accordingly (Table 1). Patients were reviewed at the Day Care Unit by both anesthetists and surgeons. Instructions and information on perioperative events were given.

Standardized anesthetic techniques were adopted. Specifically, the choice of less emetogenic anesthetic agents and avoidance of dehydration were applied. Mask ventilation was carefully performed to prevent inflation of stomach during. We also applied multimodal analgesic and pre-emptive approach to reduce the incidence of perioperative anesthetic complications such as pain, nausea and vomiting. This include the use of ibuprofen 100 mg orally on admission, propofol for induction of anesthesia, local anesthetic infiltration before skin incision, intravenous fentanyl and supplement with intravenous ketoralac if necessary, expulsion of residual gas and

Table 1: Inclusion and exclusion criteria for ambulatory laparoscopic cholecystectomy.

Inclusion criteria	
Diagnosis	Symptomatic Gallstone
	Gall Bladder polyp
Age	20-70 years
ASA classification	I or II
Social factors	With family support
	Living in a building with lift
Diagnosis	Acute cholecystitis
	Acute pancreatitis
	Calcified gallstone
	Carcinoma of gallbladder
	Chronic cholecystitis
	Cholecystoenteric fistula
	Stones in the main biliary duct
Exclusion criteria	
Contraindication to laparoscopic procedure	Previous upper abdominal operations
Medical conditions	Obstructive sleep apnea syndrome
	BMI > 30
	Poor cognition
	Perceived frailty
	General poor state of health
Social factors	Living alone/lack of social support

ondansetron for nausea and vomiting before wound closure, fentanyl was used for rescue analgesia in phase I recovery room.

Surgery was performed by experienced senior surgeons. A novel method using only 2 ports at supraumbilical site (1 mm) and epigastric area (3 mm) was adopted.[26] The laparoscopes were modified to have a camera on a side branch and a direct built-in working channel was used as a grasping forcep. The cystic duct was tied by Tayside's extracorporeal knot using a tailor-made pusher through the 3 mm epigastric port.

Postoperatively, patients were transported to the phase II recovery room in the Day Care Centre. Pain management was provided by oral dologesic or ibuprofen as necessary. Before leaving from the hospital, all patients were assessed by anesthetists at around 3-4 o'clock in the afternoon to ensure the fitness for discharge. Discharge criteria are shown in Table 2.

Before discharge, all patients were assessed by the nursing staff on severity of pain (visual analogue scale, 0-10), satisfaction (1 = very satisfied, 2 = satisfied, 3 = unsatisfied, 4 = very unsatisfied), severity of postoperative nausea and vomiting (1 = no PONV, 2 = mild PONV without requirement for medication, 3 = PONV relieved by medication, 4 = severe PONV not relived by medication) and the presence and frequency vomiting. Before returning home, each patient received oral dologesic or ibuprofen if needed. Instructions were given by the nursing staff on postoperative care. We also established a 24-hour hotline operated by nursing staff for easy patient contact in case problem arose during non-office hour. There was also a separate contact number during office hour. All patients were contacted again during the first 24-hour to check on their well-being.

A Z-test for the difference between two population proportions was performed to determine the difference in discharge rate between our data and those reported locally and internationally (Table 3). The differences in the percentages of successful discharges between hospitals were tested at the 95% significance level. Therefore, an absolute z value > 1.96 indicates a significant result.

Table 2: Discharge criteria.

Parameters	Scores
Vital signs	
Within 20% of preoperative values	2
Between 20-40% of preoperative values	1
>40% or <40% of preoperative values	0
Ambulation and mental status	
Oriented AND gait steady	2
Oriented OR gait steady	1
Neither	0
Pain, nausea or vomiting	
Minimal	2
Moderate	1
Severe	0
Surgical bleeding	
Minimal	2
Moderate	1
Severe	0
Intake and output	
Has had oral fluids AND voided	2
Has had oral fluids OR voided	1
Neither	0

Note: Patient must achieve a score ≥ 9, to be eligible for discharge.

Results

During the 13-months period, 136 ambulatory laparoscopic cholecystectomy were performed. There were 87 female and 49 male patients. The median (range) age was 49 (22-69) years. 126 patients had gallstone, 4 patients had polyps, 3 cholesterolosis, 2 chronic cholecystitis and 1 patient had both gall stone and chronic cholecystitis.

There was only one case of readmission (0.81%) on day 2 due to bile leak. The patient presented with abdominal pain. Twelve out of 136 patients were unable to be discharged from hospital on the day of operation giving the same day discharge rate of 91%. Six were converted to open cholecystectomy, three were due to pain,

Table 3: Same day discharge rate of published reports. *$P < 0.05$

Reference	Country	Number of patients	Same day discharge rate	Z-score
17	HK	60	91%	-0.23
18	HK	73	88%	0.69
19	HK	35	77%	2.27*
20	UK	170	71.1%	4.35*
21	UK	41	80%	1.97*
22	UK	357	85.7%	1.48
23	USA	731	96.6%	-3.28*
24	USA	888	96.8	-3.33*
25	Sweden	100	89%	0.51

one for persistent hypotension postoperatively, one for severe postoperative nausea and vomiting and one had a significant drop of hemoglobin (from 10.5 to 9.4 g/dL). The median (range) pain score was 5 (0-10) and the satisfaction score was 3 (2-4). 36 patients (26.5%) had PONV after surgery, 12 patients (8.8%) required rescue antiemetics. All the data were taken during the assessment of the patients at around 5 o'clock in the afternoon before they were discharged. The results of z-test comparing the same day discharge rate of the Tuen Mun Hospital with that of the other hospitals are shown in Table 3.

Discussion

Our study showed that the same day discharge rate (91%) was quite high and was comparable to overseas reports. Indeed, half of the patients (6 out of 12) required overnight stay were due to surgical problems requiring conversion into an open procedure and one patient (8%) was due to late schedule. Only 25% of the patients (3 patients) were due to pain, one (8%) had vasovagal attack, and another patient had PONV.

As far as selection criteria are concern, the major differences are seen in the ASA classification and age. One hospital included 2 patients of ASA III, however, this has no effect on unplanned admission and complication rate. Both patients were discharge promptly on the operating day and recovered smoothly over time.[10] The difference in age of patient groups for different hospitals is obvious; however, the rate of unplanned admission and the rate of postoperative complications were not related to age in these reports.

Anesthetic practice varied among hospitals and between different anesthetists in the same hospital. One report indicated no premedication was prescribed.[16] Others used paracetamol suppository and ondansetron.[20,21] In the Tuen Mun Hospital, we gave ibuprofen 100 mg as premediction.

In the literature, all patients were paralyzed, and their tracheas were intubated and the lungs were ventilated. However, anesthetic agents varied widely with target controlled infusions of propofol and remifentanil to isoflurane, desflurane or sevoflurane with nitrous oxide.[15-24] In the Tuen Mun Hospital, we used sevoflurane with nitrous oxide.

Pain management also varied among hospitals. Multimodal analgesia was adopted by many institutions.[27] Injection of bupivacaine at the wound site was a common practice at the end of prodedure.[15-22] In other reports, intramuscular diclofenic 75 mg and tramadol 100 mg IVI were also prescribed.[23] We worried that oral analgesic preoperatively and intravenous fentanyl might be insufficient to

control pain and have therefore supplemented with intravenous ketorolac during the operation. This was subsequently replaced by oral ibuprofen premedication 1-2 hours before the operation.

With regard to unplanned admission, majority of cases were due to medical complications. Most were related to pain, nausea and vomiting. However, 20-25% of patients were due to social factors and a small number of cases were due to surgical reasons like conversion to open procedures, perforated empyema.[15-24] The same day discharge rate at the Tuen Mun Hospital was comparable to other published reports. It should be noted that, although there are statistical difference among hospitals, this is heavily influenced by the sample size. Similarly, although laparoscopic cholecystectomy is a simple and straight forward procedure in experienced hands, the various steps of the whole process could be completely different in different centers, and it is hard to draw conclusion from wide range of variation in practice.

In conclusion, this survey showed that the ambulatory laparoscopic cholecystectomy is a safe, feasible procedure that is the preferred choice among patients. The same day discharge rate is comparable to both local and international standards. One area of concern is that pain management in the phase II recovery unit and this could be improved. We plan to introduce the use of a regular and a rescue analgesic regimen in the phase II recovery. Overall ambulatory laparoscopic cholecystectomy has proven to be a very beneficial procedure and its services should be greatly expanded to the public.

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Patient Controlled Epidural Analgesia with Ropivacaine and Fentanyl: An Study of Different Ropivacaine Concentrations

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SUMMARY

Ropivacaine with fentanyl 2 μg/ml was used for patient controlled epidural analgesia (PCEA) during the period of January to October 2000. During this period, the concentration of ropivacaine was changed from 0.2% with a 2 ml bolus, lockout of 5 minutes and an hourly maximum of 12 ml sequentially to 0.1%, and then finally to 0.15%, with a 4 ml bolus, 10-minute lockout and 20 ml hourly maximum. We recorded the pain score (0-10) at rest and on movement. Other parameters recorded included duration PCEA used, volume of solution used, sedation, nausea and vomiting, mobility, oral intake, itch, urinary retention, hypotension, respiratory depression, desaturation, headaches, limb weakness, patients' satisfaction, and comments from the patients. The only significant difference was in the volume of solution used. This was greater when using ropivacaine 0.1% and 0.15% compared with 0.2%. Our finding has cost implication for the cassettes to be used. The pain scores at rest and on movement, satisfaction scores and comment from patients were similar across all groups. The incidence of side effects was small and was similar among groups.

Key words: Postoperative pain; Patient controlled epidural analgesia; Ropivacaine

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Ropivacaine is a long acting local anesthetic agent. It is presented as a pure S-form enantiomer, which is less toxic and has a longer duration of action than the R-form enantiomer or the mixture of S- and R-forms.[1] At low doses, ropivacaine demonstrates a sensory-motor block separation. This has the advantage of providing analgesia with reduced motor block making it suitable for post-operative epidural analgesia.[2]

A dose finding study of ropivacaine alone for epidural analgesia showed that epidural infusion of 0.2% provided the best balance of analgesia with minimal motor block.[3] The use of epidural opioid in combination with local anesthetics produces synergistic analgesic action and reduces the required dose and side effects associated with the opioid or local anesthetic alone.[6] We postulated that the addition of

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fentanyl would allow a more dilute solution of ropivacaine to be used.

The aim of this study was to compare the use of different concentrations of ropivacaine with fentanyl during patient controlled epidural analgesia (PCEA) in the postoperative setting.

Materials and Methods

The study was conducted using our acute pain service audit data. The dataset was collected prospectively. All patients receiving PCEA for postoperative analgesia during the study period were included in the study. Ropivacaine with fentanyl 2 μg/ml for PCEA was used for the period from January to October 2000. The concentration of ropivacaine was changed sequentially during this period. From January 2 to May 10, 2000, we used ropivacaine 0.2% with a 2 ml bolus, a lockout period of 5 minutes and an hourly maximum of 12 ml. From May 11 to July 31, this was changed to 0.1%, and between August 1 and October 30, this was again changed to 0.15%, with a 4 ml bolus, 10-minute lockout period and 20 ml hourly maximum. We used a Graseby 9300 PCA pump (Graseby Medical Ltd, Watford, Herts, UK) with a 100 ml infusion reservoir cassette (SIMS Graseby Ltd, Watford, Herts, UK). Intraoperative anesthesia technique and epidural drug administration was selected according to the attending anesthesiologists.

Routine observations on the ward consisted of pain scores and vital signs charted every second hour by ward nurses with review during acute pain rounds conducted three times daily by anesthesiologists. We had a routine audit for our acute pain service during this period. The audit was conducted by the pain nurse until the anesthesiologist and patient agreed to remove the epidural catheter and PCEA. The audit included a record of pain scores (numerical response scale from 0 = no pain to 10 = worst pain) at rest and on movement, duration that PCEA was used, and volume of solution used. Hypotension (systolic blood pressure less that 90 mmHg or 30% less than baseline, respiratory depression (respiratory rate less than 12), desaturation ($SpO_2 \leq 90\%$), patients' satisfaction (0 = poor, 1 = fair, 2 = good, 3 = excellent), and comments from the patients (0 = will never use again, 1 = may try again, 2 = will try again, 3 = will recommend to others) were recorded. Sedation score (0 = awake, 1 = drowsy, 2 = unrousable), nausea and vomiting score (0 = nil, 1 = nausea, 2 = vomited once in an hour, 3 = more than once an hour, 4 = required treatment), mobility score (0 = bed rest, 1 = sitting out, 2 = freely mobile), oral intake (0 = nil by mouth, 1 = sips of water, 2 = fluid diet, 3 = normal diet), itch (0 = nil, 1 = mild, 2 = moderate, 3 = severe, 4 = required treatment), urinary retention (0 = passed urine, 1 = catheterised intra-op, 2 = urinary retention), headache (0 = nil, 1 = mild, 2 = moderate, 3 = severe, 4 = required blood patch) and limb weakness according to the Bromage scale (0 = can move hip, 1 = knee, 2 = ankle, 3 = no movement, 4 = requires follow up) were recorded.

In this study we compared the dataset during the three periods when PCEA regimens were changed. Parametric data were tested by analysis of variance for intergroup comparison, the non-parametric data were analyzed by Kruskal Wallis test. A P value < 0.05 was considered significant.

Results

A total of 289 patients were analyzed. There were 89 males and 200 females. The mean (± standard deviation, SD) age was 49.5 ± 20 years. There was no significant difference in the demographic data between groups. The mean ± SD duration of PCEA was 46.3 ± 30.7 hours and the mean ± SD volume of solution used was 167.0 ± 130.9 ml. The results for the total scores are summarized in the Table 1.

The volume of solution used was greater in ropivacaine groups 0.1% and 0.15% compared with 0.2% ($P < 0.05$), but there was no significant difference between ropivacaine 0.1% and 0.15%

Table 1: Usage of patient controlled epidural analgesia, pain scores and satisfaction after surgery.
Values are number of patients or mean ± standard deviation

	Ropivacaine			*P* value
	0.2%*	0.15%	0.1%	
All patients				
Number of patients	103	89	97	
Age (years)	52.9 ± 20.4	53.6 ± 19.4	54.6 ± 21.1	0.33
Gender (Male:Female)	31 : 72	25 : 64	33 : 64	0.32
Duration (hour)	40.0 ± 28.8	48.6 ± 29.3	50.9 ± 34.0	0.16
Volume used (ml)	107.0 ± 78.6	208.4 ± 174.8	192.6 ± 146.1	< 0.05*
Pain score (rest)	2.19 ± 1.62	2.19 ± 1.64	2.62 ± 1.45	0.52
Pain score (movement)	4.08 ± 1.68	4.25 ± 2.19	4.30 ± 1.73	0.18
Satisfaction (0/1/2/3)	4/19/52/29	4/15/49/21	3/18/40/36	0.39
Comments (0/1/2/3)	2/27/47/28	3/9/48/29	3/10/58/26	0.39
General surgery patients				
Number of patients	22	22	29	
Age (years)	66.4 ± 12.8	63.4 ± 14.4	71.4 ± 12.8	0.10
Gender (Male:Female)	14 : 8	16 : 7	17 : 12	0.73
Duration (hour)	60.0 ± 29.2	73.5 ± 24.6	66.6 ± 33.6	0.33
Volume used (ml)	139 ± 81.9	381.3 ± 198.6	260.8 ± 167.2	< 0.001*
Pain score (rest)	2.14 ± 1.52	2.217 ± 1.38	3.03 ± 1.65	0.07
Pain score (movement)	4.23 ± 1.23	4.4 ± 2.62	4.86 ± 1.99	0.55
Satisfaction (0/1/2/3)	0/1/15/6	1/2/14/25	1/5/9/14	0.61
Comments (0/1/2/3)	1/4/12/5	2/1/16/25	1/3/20/5	0.98
Orthopedic patients				
Number of patients	42	28	30	
Age (years)	66.2 ± 13.9	67.0 ± 10.5	66.0 ± 12.2	0.95
Gender (Male:Female)	17 : 25	6 : 22	12 :18	0.22
Duration (hour)	48.2 ± 25.8	55.0 ± 23.8	63.7 ± 22.1	0.04*
Volume used (ml)	120.7 ± 86.1	175.6 ± 132.2	204.9 ± 123.0	0.01*
Pain score (rest)	2.38 ± 1.84	2.46 ± 2.01	2.63 ± 1.33	0.84
Pain score (movement)	4.17 ± 1.81	4.5 ± 2.11	4.07 ± 1.31	0.63
Satisfaction (0/1/2/3)	3/7/18/14	1/5/15/7	0/5/15/10	0.76
Comments (0/1/2/3)	0/12/19/11	0/5/13/10	1/5/15/9	0.52
Obstetric patients				
Number of patients	39	38	38	
Age (years)	31.0 ± 5.0	37.7 ± 14.7	33.0 ± 9.4	0.31
Duration (hour)	19.8 ± 16.8	28.7 ± 19.9	22.8 ± 14.2	0.25
Volume used (ml)	74.3 ± 52.1	127.9 ± 93.2	109.6 ± 67.7	0.01*
Pain score (rest)	2.03 ± 1.39	1.97 ± 1.40	2.25 ± 1.28	0.62
Pain score (movement)	3.90 ± 1.74	3.92 ± 1.87	3.97 ± 1.67	0.93
Satisfaction (0/1/2/3)	1/11/18/9	2/8/20/8	2/8/16/12	0.70
Comments (0/1/2/3)	1/11/15/12	1/3/19/15	1/2/23/12	0.26

Patient satisfaction is rated as 0 = poor, 1 = fair, 2 = good, 3 = excellent, and comments from the patient is rated as 0 = will never use again, 1 = may try again, 2 = will try again, 3 = will recommend to others

with a small increase in volume used in the 0.15% group. The results were then analyzed according to operation type (Table 2). The volume of solution used was less using ropivacaine 0.2% compared with both ropivacaine 0.1% and 0.15%. In the orthopedic type of surgery there was significant difference in the duration that PCEA was used in

ropivacaine 0.2% compared to ropivacaine 0.1% (P= 0.04).

Concerning the sedation scores, only one patient in each of the 0.2% and 0.1% group and two patients in the ropivacaine 0.15% group had drowsiness, and no patients were considered unrousable. Eight patients in the ropivacaine 0.2% group complained of nausea or vomiting. One of these patients requiring treatment. In the 0.15% group, 14 complained of nausea and vomiting with one requiring treatment and in the 0.1% group, 11 complained of nausea or vomiting with three requiring treatment. At the time of removal of epidural catheter, eight patients in both the 0.2% and 0.15% groups and 11 patients in the 0.1% group had not resumed oral intake. 70 patients in the 0.2% group were still on bed rest compared to 48 in the 0.1% group and 43 in the 0.15% group.

Five patients in the 0.2% group, four in the 0.15% group and only one in the 0.1% group had a Bromage score of greater than 1. Urinary retention occurred in four of the 0.2% group, eight of the 0.1% group and nine of the 0.15% groups. There was one episode of hypotension in the 0.2% group. Similarly, 14 in the 0.1% group and 18 of the 0.15% group had hypotension. There were no incidences of respiratory depression (rate less than 12) in any group. There was one episode of desaturation in each of the 0.15% and 0.2% groups, and six in the 0.1%. Itch occurred in eight of the 0.2% group, 20 of the 0.15% group and 21 of the 0.1% group. Headache occurred in one of the 0.2% group, nine of the 0.1% and 11 of the 0.15% groups.

Discussion

There was a significant difference in the volume of epidural solution used with different concentrations of ropivacaine. This was significantly greater when using ropivacaine 0.1% and 0.15% compared to ropivacaine 0.2%. No differences in volumes used were found between ropivacaine 0.1% and 0.15% groups. When the data is explored according to surgical disciplines, this is consistent in all types of operations and is especially pronounced in general surgery. The difference in volumes used may reflect a decrease in efficacy of the weaker ropivacaine solutions requiring a greater volume to be used, although the pain scores and satisfaction remained similar. Difference in volumes used may also be partly due to the difference in PCEA settings as the ropivacaine 0.2% group was allowed a bolus of 2 ml with a 10-min lockout and 12 ml hourly limit compared to the ropivacaine 0.15% and 0.1% which had a 4 ml bolus, 10 minute lockout and 20 ml 1 hour limit. This would favor the smaller volumes observe in the ropivacaine 0.2% group.

This difference in volume used has cost implications as the cassettes used contain only 100 mls, and so a greater volume will consume a greater number of cassettes. Each 100 ml cassette cost HK$95 and a 20 ml ampoule of 1% ropivacaine costs HK$68 (prices quoted for year 2000). One ampoule of ropivacaine is required to make 100 ml of ropivacaine 0.2% making a total cost of HK$163. To make a solution of ropivacaine 0.1%, only 10 mls of an ampoule of 1% ropivacaine would be used. The remaining 10 mls may be used for generating another cassette of 0.1% solution or be subjected to wastage.

One of the reasons that we changed to ropivacaine 0.15% was the lack of stock of the 1% ropivacaine from the suppliers. Ampoules of 0.75% ropivacaine were used instead at a cost of HK$50 per ampoule. The cost of normal saline for dilution and fentanyl was similar between groups. Therefore, one cassette of ropivacaine 0.2% incurred a cost of HK$163 and ropivacaine 0.15% costed HK$145 per cassette. A cassette of 0.1% ropivacaine costed HK$129 per cassette if two cassettes were generated but had higher cost equivalent to the ropivacaine 0.2% if only one cassette was prepared. Assuming the mean volumes of ropivacaine 0.2%, 0.15% and 0.1% were 107.0, 208.4 and 192.6 ml, respectively, and calculate cost per ml of solution used, this would be a total cost of HK$174.41 for

ropivacaine 0.2%, HK$302.18 for ropivacaine 0.15% and HK$248.45 for ropivacaine 0.1%. However as the unit price is for a 100 ml cassette and this represents approximately 1 cassette of ropivacaine 0.2% at HKD $163 compared with 2 cassettes of 0.15% at HKD $270 or 0.1% at HKD $238. Because of cost concerns, the PCEA would often be terminated after completion of the first cassette. We did not calculate the volumes of solution wasted in this audit.

The difference in volume used is consistent with those reported in the literature. In the dose finding study, comparing saline, ropivacaine 0.1%, 0.2% and 0.3%, the need for rescue PCA morphine was significantly less in the ropivacaine 0.2%, although they used a fixed rate on epidural infusion of 10 ml/h.[3] This indicates a greater efficacy of the 0.2% ropivacaine solution. A further study comparing the addition of fentanyl of 2 or 4 μg/ml to a ropivacaine 0.2% solution found that the addition of fentanyl reduced the number of patients requiring the maximum infusion rate of 14 ml/h.[4]

The actual mass of ropivacaine used was similar in the 0.2% group (214 ± 157 mg) and 0.1% group (193 ± 146 mg), but increased in the ropivacaine 0.15% group (313 ± 262 mg). This mass of ropivacaine has also cost implications for the number of ampoules diluted. A greater mass administered potentially increases the risks for toxic effects. However, the total mass used did not produce adverse effects over the period of 2 to 3 days. The increase in volume for the same mass of drug has some theoretical advantage in increasing spread and reducing missed segments. The increase in volume and mass when using ropivacaine 0.15% is difficult to explain. Because patients and medical staff were aware of the concentration of epidural solution, other factors such as encouragement from the acute pain service or ward nurses may have altered the patient's demands.

The duration that the PCEA used was longer during the ropivacaine 0.1 % and 0.15% period compared with the 0.2% period. But it was not significantly different in orthopedic surgery. This may have reflected a difference in policy of the acute pain service during the period of audit. The duration of PCEA was prolonged to improve continuous passive mobilization after joint replacement surgery. The duration of infusion was very short for all ropivacaine groups in obstetric surgery as the new mothers frequently requested early removal of their catheters to facilitate caring for their infant. If we assess the volume per hour, the ropivacaine 0.2% group used 2.7 ± 2.7 ml/h, which was less compared to the 0.1% group 3.78 ± 4.3 ml/h and 0.15% group 4.3 ± 6.0 ml/h. This volume per hour is much less than the 10 ml/h and 8 ml/h titrating up to 14 ml/h infusion rates quoted in the literature.[3,4] This may reflect the finding that PCEA uses less volume compared to continuous epidural infusion. PCEA allows the patient to titrate the amount of drug to their level of tolerance whereas a continuous infusion may administer drug at times when the patient has no need for analgesia. A study in labor pain using bupivacaine and sufentanil showed that compared to the continuous epidural infusion technique, PCEA allows a decrease in local anesthetic consumption without impairing the quality of anesthesia.[5] PCEA may be able to reduce the local anesthetic requirement and reduce the side effects. Studies with intravenous PCA show an increase in patient satisfaction compared to infusions of analgesics.

The pain scores at rest and on movement, satisfaction scores and comments from patients were similar among all groups. Using the PCEA method, the patient can make sufficient demands to achieve adequate pain control and will limit the demands to reduce side effects. Although there was a trend towards lower pain scores in the 0.2% ropivacaine group, pain at rest did not reach statistical significance. The pain scores on movement were above 4 for the general surgical and orthopedic groups, which may not be acceptable in some institutions. In the ropivacaine 0.2% and fentanyl study, the number of patients with PCEA failure requiring discontinuation was significantly less with

fentanyl 4 μg/ml as was the VAS pain scores at rest and with cough compared to ropivacaine alone.[4] The authors concluded that the addition of 4 μg/ml of fentanyl was the most effective regimen.[4] We have been adding fentanyl 2 μg/ml; perhaps increasing the fentanyl concentration could improve the pain scores.

The incidence of side effects was small and similar among the groups. There were more patients with Bromage score greater than 1 in the 0.2% group (n = 5) and 0.15% group (n = 4) compared with 0.1% group (n = 11). There was a marked difference in the number of patients who were still on bed rest in the 0.2% group (n = 70) compared to the 0.1% group (n = 48) and 0.15% group (n = 43). This may have been due to the increase in motor block of the higher ropivacaine concentration, however as this was a longitudinal study, other policy differences changing over time could have contributed. The study comparing ropivacaine 0.1, 0.2, and 0.3% epidural infusion also showed significant increase in motor block in the 0.3% group compared to both 0.1 and 0.2% groups, but no difference between 0.1 and 0.2% groups.[3]

There was an increase in episodes of hypotension in patients receiving larger volumes: 14 episodes in the 0.1% group, 18 in 0.15% group compared with 1 in the 0.2% group. The larger volume used may have resulted in a higher spread of the sympathetic blockade contributing to the hypotension. More episodes of desaturation occurred in ropivacaine 0.1% (n = 6) compared with 0.15% (n = 1) and 0.2% (n = 1) groups. As the fentanyl concentration was kept constant, an increase in volume would result in more fentanyl delivered: 214 μg in the 0.2% group compared to 385 μg in the 0.1% group. A mean dose of fentanyl 416 μg was used in 0.15% but the number of episodes of desaturation was similar to the 0.2% group. In addition, pruritus, sedation and nausea and vomiting may be related to the fentanyl dosage. However the incidence was low and it was difficult to compare among groups. Urinary retention occurred less often in the 0.2% group (n = 4) compared with the groups with higher volumes 0.1% (n = 8) and 0.15% (n = 9). However the overall incidence was small and many patients required catheters for their surgery. Spinal opioid has been implicated in contributing to urinary retention.

Conclusion

We concluded that the use of PCEA for post-operative analgesia with ropivacaine 0.2%, 0.15% and 0.1% and fentanyl 2 μg/ml were similar in efficacy as measured by pain scores and patient satisfaction. The incidence of side effects was similar in different drug concentration. There was a significant decrease in the volume infused with ropivacaine 0.2% compared with ropivacaine 0.1% and 0.15% with fentanyl 2 μg/ml. This may have cost implication and our findings should be confirmed by further prospective randomized study.

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"Group" registration welcome if you can find your own partners to form a group of four. Mutually agreed dates may be arranged. Sessions will be videotaped. All participants in the workshop will be required to sign a confidentiality statement.

Prolonged Paralysis after Suxamethonium: A New Gene Mutation

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SUMMARY

We describe a case of new butyrylcholinesterase (BCHE) gene mutation. The patient has prolonged apnea after administration of succinylcholine. DNA analysis showed that he has two mutations in the BCHE gene, one novel and one that is already known.

Keywords: Butyrylcholinesterase (BCHE); Succinylcholine; Gene Mutation; Silent variant

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Butyrylcholinesterase (BCHE, also known as serum cholinesterase, plasma cholinesterase or pseudocholinesterase) is found in human plasma and the brain. This enzyme is responsible for hydrolysis of succinylcholine, mivacurium, procaine, cocaine and heroin. Variant of BCHE was first discovered because these patients responded to succinylcholine in an unusual fashion. By using different biochemical techniques such as dibucaine and fluoride test, different variants have been described. These included the *atypical variant*, *fluoride resistant variant*, *silent variant*, *K-variant* and *J-variant*.[1,2] With the application of molecular biology, the cholinesterase gene has been isolated and sequenced.[3,4] Deoxyribonucleic acid (DNA) analytical technique permits precise identification of the mutations. The corresponding mutant allele produces abnormal BCHE that hydrolyze succinylcholine to different degrees.[5] La Du *et al*. has described these variants in details.[6] Currently, more than 40 BCHE mutations have been reported that are associated with low serum enzyme activities.[7]

The homozygous silent variant occurs at a frequency of 1 in 100,000.[8] The corresponding BCHE activity may be completely absent or present in very small amounts (less than 10% of normal). Heterozygous occurrence of the silent mutation is estimated to be 1:200 individuals. Heterogeneity of this phenotype is well established. Previous observation indicated that each investigation of a new silent BCHE family has about a 50% chance of finding a new mutation versus rediscovering one previously described. We report a new BCHE gene mutation and review how patients with suspected prolonged paralysis associated with succinylcholine should be managed.

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Case history

A 41 year-old, 65 kg man, was admitted to the hospital with acute appendicitis after having right lower quadrant pain for 1 day. He had an uneventful nasal surgery previously performed during general anesthesia in another hospital but the anesthetic record could not be traced. Otherwise he had no significant medical, anesthestic, drug or family history. Physical examination was unremarkable. Investigation showed a mildly elevated white cell count (14.9×10^9/L) and total bilirubin concentration (38 μmol/L). Liver enzymes were normal. He was scheduled for appendectomy through a left lower quadrant incision.

A rapid sequence induction was performed with intravenous boluses of fentanyl l00 μg, thiopentone 300 mg, succinylcholine 100 mg. This was followed by tracheal intubation. Atracurium 25 mg was given intravenously 5 minutes afterwards. Anesthesia was maintained with nitrous oxide, oxygen and isoflurane. End-tidal carbon dioxide concentration was kept at 35 mmHg. Temperature of the patient was 37°C throughout the surgery. Intraoperatively, there was a markedly inflamed appendix with gangrenous changes at tip and mildly turbid peritoneal fluid. This was removed and the operation lasted for about 60 minutes. A peripheral nerve stimulator placed at the left forearm showed no response to the train of four (TOF) or 100-Hz tetanic stimulation during the procedure. At the end of surgery, there were no clinical signs indicating a return of muscle power. Another nerve stimulator placed at the right forearm also showed the same result. He was sedated and the lungs were ventilated while the cause for prolonged neuromuscular block was being investigated. Arterial blood gas and serum electrolytes did not reveal significant abnormalities.

The first twitch of TOF returned at 180 min after succinylcholine administration. Atropine 1.2 mg and neostigmine 2.5 mg were then administered to patient. TOF showed all four twitches 5 minutes later but this was associated with significant fade. Isoflurane and nitrous oxide was turned off. The patient became fully awake shortly. However, the muscle power was still weak and he could not move against gravity. Tidal volume was inadequate. After the patient was informed about his condition, he was sedated again and was transferred to Intensive Care Unit (ICU) for ventilatory support. About 14 hours after the succinylcholine injection, his trachea was extubated with full return of muscle power. He was discharged home 4 days after admission.

Further blood tests were performed. Blood was sent for BCHE activity and the result was grossly abnormal 0.2 kIU/L (reference range 4-10 kIU/L). Anti-mitochondrial, anti-nuclear and anti-striated muscle antibodies were all negative indicating that the patient was unlikely to have any muscle disease. In view of the very low BCHE level, we attempted to define the phenotype using dibucaine test. However the dibucaine number could not be determined because the enzyme activity was too low. Blood was then sent for genotype determination.

Genomic DNA was isolated from the patient's blood. It was then amplified by polymerase chain reactions (PCR). After purification of the PCR products, cycle sequencing was performed with dye-labeled dideoxynucleotides. The sequence reaction products were analyzed by an automatic sequencer. The nucleotide sequence of the patient's BCHE gene was determined, and mutations were detected by direct comparison with the sequence of a normal genotype.

After discharge, the patient and his family were invited to come back for genetic analysis. The parents of the patient had died some years ago and all of his siblings were not reachable. We were only able to analyze samples from the patient's two children.

Molecular Genetic Profile

The DNA analysis revealed that the patient has two mutations.[10] One mutation was confirmed as a known frame shift mutation 1020_1021 insA i.e. insertion of an adenine between the codons encoding Phe 312 and Lys313. The other is a novel mutation F474L, locatedd at nucleotide position 1504, changing codon 502 from TTT to CTT i.e. 1504 T>C and resulting in the substitution of phenylalanine by leucine at residue 474 of the mature peptide. Therefore, the patient is a compound heterozygous. This explains why the patient enzyme level is unexpectedly low. Accordingly, the patient's two children are both heterozygous for the mutation F474L. Because silent allele is recessive, their enzyme activity is within the normal range. Patient was informed about the results and was advice not to receive succinylcholine, mivacurium in future anesthesia. A letter was issued to him to explain the condition.

Discussion

Causes for prolonged postoperative apnea after anesthesia

Prolonged apnea after anesthesia could be due to central or peripheral causes. Central causes refer to problems in the central nervous system such as hypothermia, carbon dioxide narcosis, excessive volatile agents or brainstem damage.

Peripheral causes are problems in the muscle or neuromuscular junction. This includes overdosage of non-depolarizing neuromuscular blocking agent, drugs interaction, renal and liver disease, BCHE deficiency, electrolytes disturbance and muscle disease.

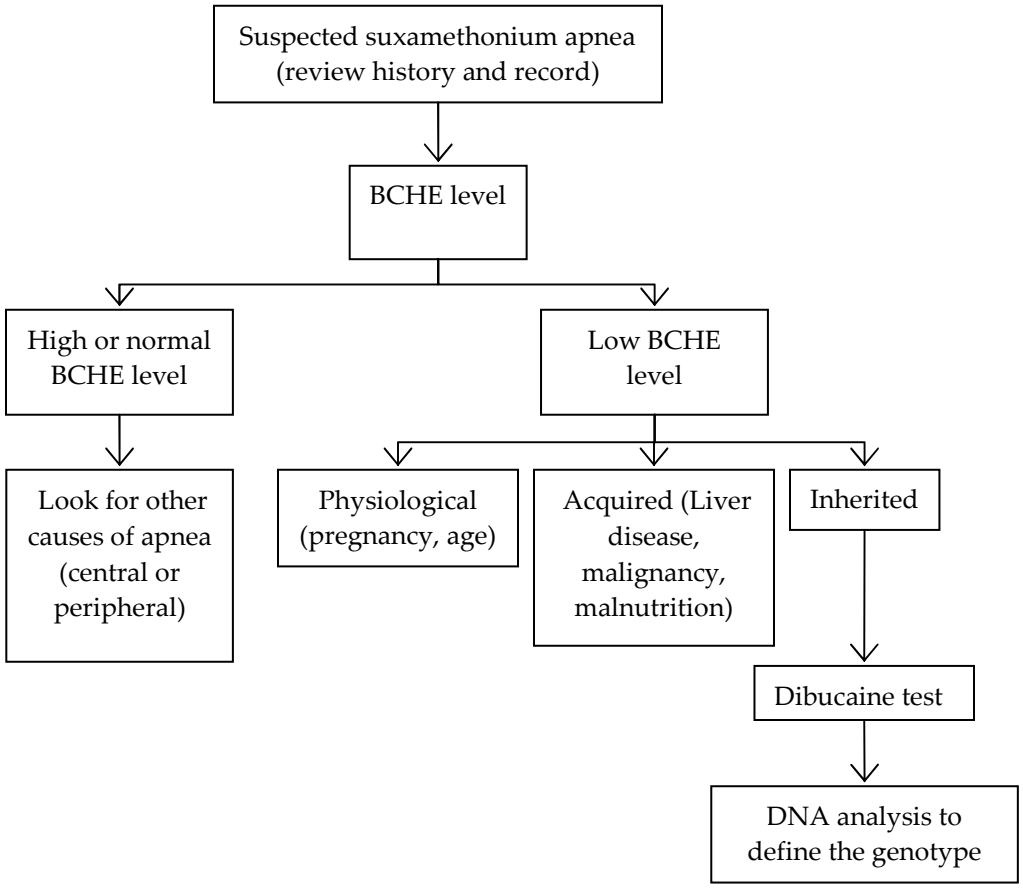
We administered atracurium to our patient. It is eliminated mainly by spontaneous non-enzymatic base catalyzed degradation (Hofmann elimination) at normal body temperature and pH. It is also hydrolyzed simultaneously by nonspecific plasma esterases.[10] These two routes of metabolism are independent of hepatic and renal function as well as plasma cholinesterase activity.[11] As such, the duration of atracurium-induced neuron-muscular blockade is similar in normal individuals and patients with absent or impaired renal or hepatic function or those with atypical plasma cholinesterase.[12] Absence of prolonged neuromuscular blockade after administration of atracurium to patients with atypical cholinesterase emphasizes the dependence of ester hydrolysis of atracurium on nonspecific plasma esterases. This pathway is unrelated to plasma cholinesterase.[13] There are no report on prolonged paralysis due to atracurium alone in normal patient. Therefore, in this patient, BCHE deficiency is the most likely diagnosis.

Investigations for suspected succinylcholine apnea (Figure 1)

BCHE level is the first laboratory test of choice if succinylcholine apnea is suspected. BCHE activity can be determined by adding sample serum to benzoylcholine. Enzymatic reaction is then measured spectrophotometrically. Most laboratories use butyrylcholine instead of benzoylcholine because it is a more specific substrate. Individual laboratory may however has its own set of reference values because of different substrate and method used. One interesting point about BCHE is that it is normally present in the body in large amount. This explains the short duration of action for succinylcholine. Apart from metabolism of drugs, the physiological function of BCHE is still uncertain. Individuals without BCHE activity can be healthy with no metabolic consequence.

The causes of a low BCHE level could be physiological, acquired or inherited. Physiological variations include age and pregnancy. Acquired conditions like liver disease, malignancy, malnutrition, heart disease, burns, plasmapheresis and cardiopulmonary bypass are known to reduce BCHE activity.[15] There are also noncompetitive cholinesterase inhibitors like cyclophosphamide, ecothiopate,

Figure 1. Plan of investigation in a patient with suspected succinylcholine apnea.



organophosphates or carbamates. Whereas competitive cholinesterase inhibitors include pyridostigmine, physostigmine, neostigmine, bambuterol, pancuronium and metoclopramide.[16] Therefore the absolute BCHE assay is affected by a number of factors. This test alone cannot define the phenotype and genotype of patient. However, if a patient presented with a very low BCHE level (as in this case), he or she is likely to have inherited BCHE gene mutation.

Dibucaine number was initially used to differentiate between the normal and the atypical variant. It is the percentage inhibition of activity of plasma cholinesterase in hydrolyzing benzoylcholine under standard conditions. Dibucaine inhibits hydrolysis of benzoylcholine by the normal enzyme by 70% or more. However, this was reduced to 30% or less in the abnormal variant. An individual with a dibucaine number equal to 70 or more is homozygous for the normal genes and the plasma contains only normal enzyme. An individual with a dibucaine number less than 30 is a homozygote but carrying the two genes for the atypical variant of the enzyme. The plasma contains the atypical enzyme alone. An individual with a dibucaine number between 40 and 70 would be a heterozygote with one gene for the normal enzyme, one gene for the atypical variant. The plasma of these heterozygotes contains a mixture of the normal and the atypical types of cholinesterase.[17]

It is important to recognize that dibucaine number reflects the quality of cholinesterase enzyme and not the quantity of the enzyme in the circulating plasma. For example, a decrease in the plasma cholinesterase activity due to liver disease or administration of anticholinesterase

drugs are associated with normal dibucaine numbers. With more variants being discovered, dibucaine test was unable to differentiate the various different variants. Other inhibitors such as sodium fluoride, urea, suxamethonium and Ro2-0683 have been used to identify the various variants of BCHE.

The Danish Cholinesterase Research Unit (DCRU) established in 1973, has been using the abovementioned biochemical methods to investigate human plasma cholinesterase variants. Although most phenotypes can be recognized biochemically, DCRU suggested that there are some heterozygous variants which are very difficult or impossible to differentiate in this fashion.[18] Phenotyping plasma cholinesterase with conventional biochemical techniques frequently misclassify genotypes. There are individuals who experience prolonged response to succinylcholine are classified as homozygotes for the normal plasma cholinesterase gene by the traditional test.[19] Therefore traditional biochemical tests are not satisfactory in differentiating many variants of the enzyme.[20] Also, if the BCHE level is too low, biochemical test cannot be carry out or become unreliable. The inadequacies associated with biochemical tests together with the increasing number of possible genotypes have prompted the development of tests based on molecular biology techniques.

The DNA structural defects of the different variants include both point and frame shift mutations.[21,22] A point mutation is the substitution of one nucleotide base for another. It changes the coding information of the codon in which it occurs. This causes either the substitution of an incorrect amino acid for the proper one in the enzyme or, if the resulting codon is a stop codon, the termination of enzyme synthesis at that location. A frame shift mutation, which is the deletion or addition of a nucleotide, results in an alteration in reading frame, and the incorrect identification of all subsequent codons. It has been found that multiple mutations within a single plasma cholinesterase gene are common. Some plasma cholinesterase variants are the product of combinations of mutations.[23]

BCHE variant in Chinese population

In Hong Kong, succinylcholine apnea was first reported by Chan *et al* in 1977.[24] They described a healthy young man who underwent a Lord's dilation and became apnea for an hour after succinylcholine administration. Other causes of apnea were excluded. Plasma cholinesterase level was 0.12 kIU/L. Liu *et al* identified a novel mutation in a Chinese patient at nucleotide 943, where A was changed to T (943 A-T), causing substitution of threonine 315 by serine (T315S). The T315S mutant has half of the normal BOHE activity. It was one of the first BCHE mutations reported in Chinese.[7] This study also showed the mutation rate of the K-variant in Chinese patients was 0.1, indicating that the K-variant might also be a common mutation.

Management of succinylcholine apnea

Supportive mechanical ventilation is the mainstay of treatment for succinylcholine apnea. Other methods such as neostigmine and native human BCHE remain controversial. Some authors suggested that neostigmine had a role in the treatment of prolonged succinylcholine apnea.[27] Others believed that anticholinesterases should not be administered earlier than 90 min after administration of succinylcholine.[28] Baraka concluded that there is a broad spectrum of responses where both depolarizing and desensitization block coexist to differing degrees. In depolarizing phase, neostigmine enhances the block. When desensitization is fully established, neostigmine may be used to antagonize the block. The degree of antagonism was proportional to the degree of desensitization.[29] Lee and Katz suggested that antagonism with an anticholinesterase can be attempted if the TOF ratio is less than 0.4 and that recovery had been observed for 20-30 mins.[30]

James *et al* reported a man with silent phenotype who suffered from prolonged

neuromuscular block following the administration of succinylcholine. [31] When the surgery ended, there was evidence of nondepolarizing block. Neuromuscular monitoring showed evidence of fade with T4:T1 ratio of 0.25. Neostigmine was given however, T1 remain markedly smaller than control. Cholinesterase was given afterwards and the patient's muscle power returned to normal quickly. This report showed that even as long as 3 hours after the administration of succinylcholine, sufficient succinylcholine might persist to maintain a block unresponsive to neostigmine. Viby-Mogensen recommended cholinesterase to be the first-line therapy,[32] if necessary, it may be followed by neostigmine to antagonize any residual phase II component. This phase II block may otherwise persist for 30 min or more.

Human blood products can also be used to treat succinylcholine apnea. Many case reports, including infant, have established it usefulness.[33] There is a decrease (up to 87%) of BCHE activity when it was measured in bank blood after storage for 21 days at 4°C.[34] Much of the decrease (80%) in activity occurs during the first 2 days of storage. Freshly separated plasma shows no decline in BCHE activity for 5 days at 0°C, or for 7 weeks at -70°C. A purified form of human cholinesterase has been used to treat prolonged succinylcholine apnea.[35] It is however only available for use in Germany, Switzerland, and Austria. An intravenous dose of 90 mg of this preparation re-established spontaneous respiration in 10 minutes. A dose of 45 mg of the enzyme concentrate contains cholinesterase activity that is equivalent to 500 m1 of fresh human plasma. Although the use of blood products and the purified human enzyme have been shown to be effective, their use is still contentious because of the infectious risk of transfusion of blood product. Recombinant human BCHE exhibits similar biochemical and pharmacological features as native human BCHE and may become the first line treatment of succinylcholine apnea in the future.[36]

In our patient, because of the nearly absent BCHE activity, succinylcholine was markedly prolonged. We have given neostigmine to reverse the action of succinylcholine but it was ineffective. Blood product was not given because of the diagnosis is uncertain at that time. Since the risk of continuing mechanical ventilation in a young fit patient in ICU until full return of muscle power is very small, we believe this is the most appropriate treatment for this patient.

Apart from the acute management, patient's family members should also be screened for the gene mutation. By studying the genotype and phenotype of family members, we can understand the mode of inheritance of the gene.

Other anesthetic drugs metabolized by BCHE

Apart from succinylcholine, mivacurium and the ester containing local anesthetics are also metabolized by BCHE. In patients with normal BCHE gene, mivacurium is rapidly hydrolyzed in plasma and the duration of action is short. Patients who are homozygous for the atypical mutation, compound heterozygous for the atypical and silent mutation or homozygous for silent mutations presented with extensively prolonged apnea after a dose of mivacurium 0.12-0.2 mg/kg.[37-42] The time to full spontaneous recovery is 6-8 h compared with the usual 30 min for patients with normal BCHE. Other drugs metabolized by esterases are esmolol, diamorphine, aspirin, remifentanil. But the they appear to be less affected by plasma cholinesterase deficiency.[43,44]

Can we prevent succinylcholine apnea?

Dexter *et* al performed a cost identification analysis for succinylcholine.[47] Assumption was the cost of succinylcholine from society's perspective equals the acquisition cost of the drug plus the cost of its adverse outcomes. They estimated the cost per dose of succinylcholine was about US$37. Among this, only $0.04 was account by butyrlcholinesterase deficiency. Most of the cost was for the chance of dying or

sustaining permanent brain injury from anaphylactic or anaphylactoid reactions to succinylcholine. In view that the frequency of silent mutation of BCHE gene in Chinese is likely to be very low, a screening test for BCHE deficiency for all surgical patients is not cost effective.

If neuromuscular monitoring were to be done before induction in our patient, atracurium probably would not have been given. Diagnosis of BCHE deficiency may be made at an earlier stage with less confounding factors to consider. However, the management and outcome would be the same. Therefore, although neuromuscular monitoring should be applied to every patient who receive muscle relaxant, it cannot prevent prolonged apnea after succinylcholine.

Conclusion

We have reported a case of patient with compound heterozygous mutations in the BCHE gene. One of them is a novel mutation. Silent BCHE mutation appears to be equally rare in the Chinese. Dibucaine number was not very useful because of the very low BCHE level. Therefore, genetic study is recommended in cases with very low BCHE level. Supportive treatment appears to be the best treatment of succinylcholine apnea because of the lower risk.

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Re-expansion Pulmonary Edema after Chest Tube Drainage of Pneumothorax

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SUMMARY

We report a case of re-expansion pulmonary edema within the first hour after drainage of spontaneous pneumothorax. In this paper, we also reviewed the pathophysiology and treatment of re-expansion pulmonary edema.

Keywords: Spontaneous pneumothorax; Re-expansion pulmonary edema; Lung

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Re-expansion pulmonary edema (REPE) is an uncommon complication after treatment of spontaneous pneumothorax. The risk of death has been estimated to be as high as 20%.[1]

Most of the REPE will occur within the first hour after drainage and the remainder occurs in the next 24 hours.[2, 3] Identification of risk factors associated with this complication may help to prevent its occurrence.

Case presentation

A 57 years-old chronic smoker presented to the accidents and emergency department with recent onset dyspnea and cough. He had no fever, chills or rigor, and denied of any chest pain. He did not report any significant past medical history, nor any history of trauma. His initial vital signs showed a core temperature of 36.2°C, blood pressure was 129/91 mmHg with a regular heart rate of 90/min. The respiratory rate was 24 breath/min, and oxygen saturation (SpO_2) was 93% while breathing room air. Wheezing was noted on auscultation but there was no other specific finding on physical examination. He received oxygen 3 L/min through nasal prongs. Salbutamol and ipratropium bromide were administered via metered-dose inhaler.

His chest X-ray showed bilateral pneumothorax with total collapse of the right lung but there was no mediastinal shift. Two 24 FG chest drains were inserted and connected to the underwater seal drainage systems without suction. The procedure was uneventful and both drains were swinging as expected.

Soon after the insertion of chest drains, the patient was noted to become hypoxemic and hypotensive. There was no blood draining in the systems. High flow oxygen was administered via a non-rebreathing mask. Dopamine infusion was also started. His vital signs then were: blood pressure 96/40 mmHg, respiratory rate 24-26 breath/min, SpO_2 90-95% while breathing high concentration of oxygen. Repeated chest X-ray

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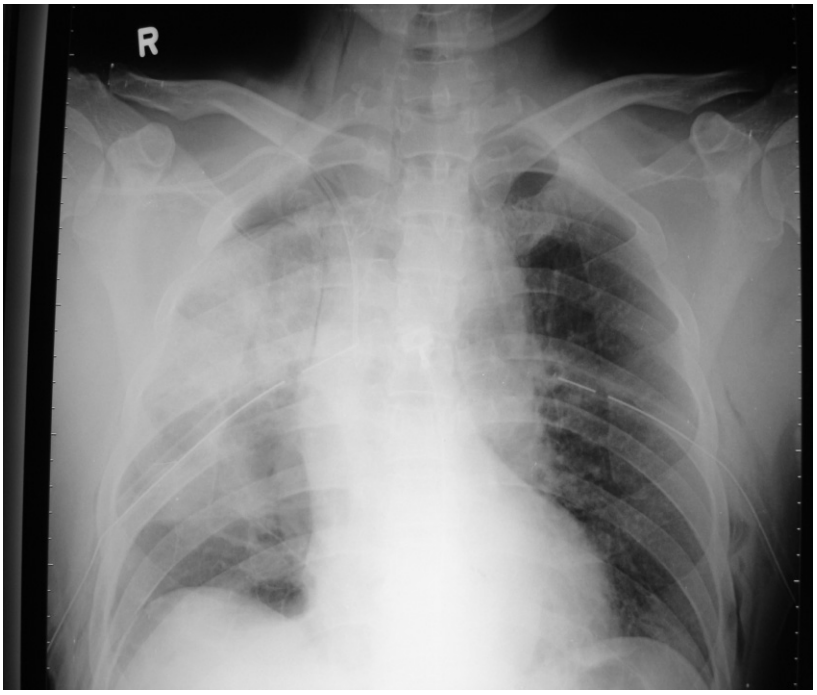
Figure 1. Chest X-ray taken after chest drain insertion.



revealed generalized hazziness mainly over his right lung field (Figure 1). A diagnosis of REPE was made.

The patient was admitted to the Intensive Care Unit (ICU). His arterial blood gases while breathing 100% oxygen showed:

pH	7.42	
$PaCO_2$	6.1	kPa
PaO_2	8.6	kPa
Base excess	4.0	mmol/L
Bicarbonate	29.7	mmol/L
SaO_2	92	%

(PaO_2=arterial oxygen tension; $PaCO_2$=arterial carbon dioxide tension; SaO_2=arterial oxygen saturation)

Dopamine infusion was eventually weaned off over the next 24 hours. Frusemide 40 mg, in divided doses, was prescribed to facilitate resolution of pulmonary edema. Subsequent microbiological investigation showed only moderate growth of oral commensals from his tracheal aspirate.

Pulmonary edema gradually resolved and his oxygen saturation also improved over the next 72 hours. He was discharged to the general ward after 3 days of ICU care and eventually transferred to another hospital for surgical pleurodesis.

Discussion

REPE is a rare but well known complication after treatment for spontaneous pneumothorax. The first case of REPE was reported by Carlson and colleagues in 1958.[4] It usually occurs shortly after drainage of the pneumothorax. Clinical features range from asymptomatic radiological changes to respiratory distress and circulatory failure. The associated hypoxemia usually does not respond well to oxygen therapy as it is due to shunting. Arterial hypotension is common and may be severe enough to cause cardiac arrest. It may be due to central pooling of blood in the thorax and myocardial depression.[5]

Edema is limited to the re-expanded lung, but it can be bilateral or even only affects the contralateral lung.[6,7] There are several possible theories for contralateral lung injury: unrecognized aspiration during conscious

sedation, relief of compressive forces after evacuation may disrupt membrane permeability. Edema may progress over 1-2 days and may persist for 4-5 days.[2,3]

Identified risk factors associated with occurrence of REPE include the followings:

1. Duration of pneumothorax. According to early case series, a minimum presence of 3 days of spontaneous pneumothorax was associated with development of REPE.[8] However, a more recent review by Matsuura showed that the severity of pneumothorax might be more predictive than its duration and there was a tendency in patients with pneumothorax > 30% of the lung field to have higher incidence.[9]
2. Rapid re-expansion;[1] and
3. Young patient. The incidence of REPE is significantly increased in patients who are 20-39 years old.[9]

Controlling for one of the above factors may not prevent the progress if the other two are present. Gender, pulmonary co-morbidities or the side of collapse were not statistically associated with REPE.[9]

The exact pathogenesis of REPE is not clearly understood and may be multifactorial. It was suggested that it may be due to the release of free radicals and inflammatory mediators after reperfusion of the collapsed lung, causing damage to the endothelial wall and increase in membrane permeability.[10] Others suggested that REPE may be the result of lymph flow disturbance and lung surfactant destruction.[10,11] Significant increase in cardiac output was noted in patients suffering from REPE compared with those who did not (+1.06 L/min *vs* -0.27 L/min). It was suggested that this increase in cardiac output may be another contributory factor in the development of REPE.[15]

Treatment of REPE is mainly supportive. Oxygen therapy is essential and mechanical ventilation may be necessary. Negative pressure suction should not be applied to the chest drain. Arterial hypotension should be treated by aggressive fluid resuscitation. Putting the patient in lateral decubitus position with the affected side up may help to improve oxygenation by reducing the shunt fraction.[12] Some authors suggested the use of non-steroidal anti-inflammatory drug but this is not confirmed by available evidence.[12] Several case reports mentioned the use of CPAP, but it is uncommon and controversial.[13] The edema is usually self-limiting and will resolve within several days up to a week. REPE is different from cardiogenic pulmonary edema in that the use of diuretics is not recommended as further deterioration may occur.[14]

Mortality was estimated to be about 20%. Most of the patients who died had their lungs collapsed for more than 3 days and had significant co-morbidity.[1]

Possible preventive measures include slow evacuation of pneumothorax if it is suspected to be present for several days already, though practically it is difficult and the "rush of air" is often unpredictable. Other measures include administration of oxygen and rehydration with fluid before drainage as well as the avoidance of suction.

The differential diagnoses of REPE are lobar pneumonia and unilateral cardiogenic pulmonary edema. The time sequence of the edema after chest drain insertion, normal white cell count and absence of fever, as well as presence of normal cardiac function may help to rule out these possibilities.

Conclusion

REPE after drainage for spontaneous pneumothorax is a rare but potentially life threatening complication. Large and prolonged duration of pneumothorax in relatively young patients drained rapidly seems to be associated

with its development. Therapy is mainly supportive.

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New Fellows "*ad eundem*"

The College recognizes the importance and contribution of anesthesiologists possessing overseas anesthesia qualifications who have decided to come and work in Hong Kong.
At a recent meeting, the Council has carefully considered and resolved to admit Drs Gordon Wong and Thomas Li as **Fellows** ***ad eundem***, FHKCA and FHKCA(IC), respectively.

Dr Gordon Wong

MBBS, BSc (Med), FAZNCA

Gordon was born in Hong Kong but migrated to Australia as a child, where he received all his secondary and university education. During his medical education, he completed a year in preclinical science research for which he was awarded a Bachelor of Medical Science. He completed his fellowship in anaesthesia with the Australian and New Zealand College of Anaesthetists in 2002. Following this, he worked for a year as a senior clinical research fellow at St Mary's Hospital London, and had a clinical attachment at Great Ormond Street Hospital for children. Subsequently, he received fellowship training in neuronanaesthesia, cardiac anaesthesia and paediatric anaesthesia with the University of Toronto, Canada for two years. For the last ten months he has been working in the Department of Anaesthesiology, University of Hong Kong, where he is involved with undergraduate teaching to medical and dental students, research and clinical work at Queen Mary Hospital. He also has an interest in transesophageal echocardiography and the use of patient simulators in teaching. He has already published several papers in international journals and presented at scientific meetings. His current research interests include cardiac preconditioning and perioperative renal function.

Dr Thomas Li

MBChB, FHKCP, MRCP(UK), FHKAM(Medicine) FJFICM

Following his graduation at The Chinese University of Hong Kong, Dr Thomas Li began a career in general medicine at the Prince of Wales Hospital. He achieved the Membership of the Royal College of Physicians of the United Kingdom, the MRCP(UK) in 1996, the Fellowship of the Hong Kong College of Physicians, the FHKCP, in September 2000 and was admitted to the Hong Kong Academy of Medicine in the same year. Following successful completion of higher training in respiratory medicine, he turned his attention to Intensive Care and completed the requirements for the Fellowship of the Joint Faculty of Intensive Care Medicine, Australian and New Zealand College of Anaesthetists and Royal Australasian College of Physicians in February 2006.

Dr. Li has a long and active teaching record. He has been involved in the tutoring and training of MRCP candidates for several years and has experience in the participation and organization of the MRCP examination, as well as preparatory mock MRCP examinations. He is currently an editor of ICU Web, an extensive, free access, web based ICU learning resource, and has contributed independent several section chapters to ICU Web. He is actively involved in teaching and producing material for the internationally used Basic Assessment and Support in Intensive Care (BASIC) course for post-graduate students of intensive care, as well as very BASIC for undergraduate students of intensive care. These activities are in addition to his participation in routine departmental teaching activities to trainees and nurses.

Dr Li has over 20 published papers in indexed journals, as well as several published abstracts and meeting presentations. His primary areas of research include asthma, pneumonia, obstructive sleep apnoea, severe acute respiratory syndrome, and infection control in intensive care. He is a member of several associations and societies including the Hong Kong Society of Critical Care Medicine.

Approved Formal Projects

YIP, Kim Ho	Local anaesthetic effect of amethocaine gel, a comparison with EMLA.
TANG, Yee Kwan	Passage of tracheal tube during oral fiberoptic intubation: A randomized comparsion of four techniques
LEUNG, Ka Ki	Evaluation of patients' perception against the modified postanaesthetic discharge scoring system for home readiness after ambulatory surgery
TSE, Kin Chung	Survey on anaesthetists' effort towards prevention of air pollution in operating theatres in Hong Kong
TAN, Kee Soon	Audit of in-hospital adult cardiopulmonary resuscitation (CPR) in a tertiary hospital in Hong Kong

The ***Formal Project Prize*** was established by the College Council. This Prize is awarded to the best paper presented at the Formal Project Prize Session, usually held as part of the College Annual Scientific Meeting (ASM)* or any other meeting approved by the Council. Registered Trainees in Anesthesia, Intensive Care or Pain Medicine and Fellows within one year of award of the corresponding Diploma of Fellowship are invited to submit the abstract of their formal projects to the organizing committee of the ASM for consideration of the award. Projects that have previously been published as a full manuscript or have been presented in another local or overseas meeting will also be considered. However, projects that have previously entered in another Formal Project Prize competition will be excluded.

The Chairman of the Board of Education will appoint at least two judges to select a number of projects for presentation during the "Formal Project Prize Session" at the ASM. The criteria for selection will be based on the scientific content of the submitted abstracts. The final assessment for the award will also include the quality of performance during the presentation and discussion afterwards.

The College reserves the right not to award the Prize if none of the project achieves a sufficiently high standard.

*The ASM 2006 "*From the Heart and Beyond*" will be held in the Convention and Exhibition Center on 18-19 November, 2006. Please visit the conference web page, http://www.hkca.edu.hk/asm2006.htm, for further details.

Future Meetings: Anesthesia, Intensive Care & Pain Medicine

Melbourne, AUSTRALIA
21-23 August 2006

4th AUSTRALASIAN CONFERENCE ON SAFETY AND QUALITY IN HEALTH CARE
Theme: "Raising the Bar for Quality".
Venue: Melbourne Exhibition and Convention Centre.
Contact: SAPMEA, 200 Greenhill Road Eastwood SA 5063. Tel: 08 8274 6060 Email: sqhc2006@sapmea.asn.au; Website: http://www.sapmea.asn.au/conventions/sqhc2006

HONG KONG
26 August 2006

RETURN TO WORK FOR PATIENTS IN PAIN
Theme: Seminar on assessment, management and outcome of work rehabilitation for pain patients
Venue: Seminar Room 1, Hospital Authority Headquarters, Argyle Street, Kowloon
Contact: Hong Kong College of Anaesthesiologists. Tel: 28718833, Fax: 28141029

HONG KONG
15-16 September 2006

eHEALTH FORUM 2006
Theme: Building a Healthy Tomorrow using IT
Venue: Hong Kong Academy of Medicine, 99 Wong Chuk Hang Road, Hong Kong
Contact: Secretariat; Te.: (852) 2778 0040; Fax: (852) 2778 0032
Email: ehealthforum2006@ehealth.org.hk

HONG KONG
14-15 October 2006
Pre-conference workshop 13 October, 2006
Post-conference workshop 16-18 October, 2006

JOINT CONFERENCE 2006 (HKPA, HKCOS OR HKARM)
Theme: Management of Neck and Back Pain: Let's do better
Venue: Centerary Room, Marco Polo Hongkong Hotel
Contact: Ms Rosanna Chau, Physiotherapy Department, Kowloon Hospital.
Tel: (852) 31297123; Fax: (852) 27627754; Email: rosanna@hongkongpa.com.hk

Queensland, AUSTRALIA
20-24 October, 2006

65th NATIONAL SCIENTIFIC CONGRESS OF THE AUSTRALIAN SOCIETY OF ANAESTHETISTS
Venue: The Hyatt Regency Coolum, Queensland
Contact: Organizers Australia. PO Box 1237, Milton, Qld 4064. Tel: +61 (0)7 3371 0333
Fax: +61 (0)7 3371 0555

SINGAPORE
6-10 November 2006

12th ASIAN AUSTRALASIAN CONGRESS OF ANAESTHESIOLOGISTS (AACA)
Theme: The Art and Science of Anaesthesiology.
Venue: Suntec Singapore Convention and Exhibition Centre.
Contact: A/Prof Dr Yew-Weng CHAN, Organising Chairman. Tel: (65) 6330 6834
Fax: (65) 6336 2123 Email: aaca2006@pacificworld.com; Website: www.aaca2006.com

HONG KONG
17-19 November, 2006

ANNUAL SCIENTIFIC MEETING 2006
Theme: Cardiothoracic and Vascular Anaesthesia
Venue: Hong Kong Convention and Exhibition Centre
Contact: ASM 2006 Secretariat, c/o International Conference Consultants, Ltd.
Unit 301, 3/F The Centre Mark, 287-299 Queen's Road Central, Hong Kong,
Tel: (852) 25599973; Fax: (852) 25479528; Email: asm2006@icc.com.hk;
Website: www.hkca.edu.hk/asm2006.htm

Chepstow Wales, UK
23-24 November 2006

ANNUAL SCIENTIFIC MEETING OF THE UK SOCIETY FOR INTRAVENOUS ANAESTHESIA
Venue: Marriott St. Pierre Hotel & Country Club.
Contact: Dr William McFadzean, Consultant Anaesthetist. Morriston Hospital,
Swansea SA6 6NL. Tel: +44 (0)1792 703279 Email: meetings@sivauk.org
Website: http://www.sivauk.org/StPierreChepstow.htm

The original press statement, published in the last issue of the Bulletin (*Bull HK Coll Anaesthesiol* 2006; 15:50), contained a number of typographical mistakes. We have therefore reproduced the whole statement in this issue again. The editor apologizes for the error.

Press Release **1 March 2006**

There has been public concern in the community recently regarding the safe use of sedative and anaesthetic drugs for minor surgery. The Hong Kong College of Anaesthesiologists and the Society of Anaesthetists of Hong Kong would like to make the following statement:

The development of modern anaesthesiology made complicated major surgery possible. When conducted properly by trained practitioners with appropriate facilities, judicious use of the analgesic, sedative and anaesthetic drugs can also allow diagnostic or minor surgical procedures to be performed outside the operating room and even outside the hospital. However, potential serious side effects associated with the use of these drugs include unconsciousness, respiratory depression, seizures and cardiac arrest. These could be lethal if not managed accordingly. To be qualified as a specialist anaesthetist in Hong Kong, medical practitioners must undergo a minimum of six years of postgraduate training and pass three professional examinations. Upon completion of training, the Fellowship of Hong Kong College of Anaesthesiologists and subsequently Fellowship of Hong Kong Academy of Medicine would be awarded. Practicing specialist anaesthetists are required to register in the Specialist Register of the Medical Council of Hong Kong and hence would be under the regulation of the Medical Council.

Although there is no restriction on the use of anaesthetic drugs by practitioners who are not specialist anaesthetists, our expertise leads us to recommend that practitioners should take the following precautions related to the use of analgesic, sedative and anaesthetic drugs:

1. Have a thorough understanding of the pharmacology of the drugs to be administered, especially the side effects.
2. Conduct an assessment of the patient to determine the suitability for sedative drugs.
3. Have another medical practitioner or a qualified nurse trained in resuscitation to monitor the patient, in addition to the practitioner or nurse who are required for and preoccupied with the procedure.
4. Have resuscitation drugs and equipment available at the location of the procedure.

Patients should be well informed of the risks inherent with the use of these analgesic, sedative and anaesthetic drugs. Specialist anaesthetists should be consulted if needed. Guidelines and recommendations regarding the safe use of sedative drugs can be found in various international anaesthetic, medical and surgical organizations, and a suggested guideline is also available from the Hong Kong College of Anaesthesiologists web site
(http://www.hkca.edu.hk).

The Hong Kong College of Anaesthesiologists
The Society of Anaesthetists of Hong Kong

Enquiry: The Hong Kong College of Anaesthesiologists Office (Tel: 28718833)

香港麻醉科醫學院及香港麻醉科學會就近日社會公眾對麻醉藥物的安全問題引起關注，特發表以下聲明：

麻醉學的發展令很多大型複雜的手術得以順利地進行，而麻醉、鎮靜及止痛藥物的普及亦讓病人在醫院外也能接受一些小型手術和檢查。但「水能載舟，亦能覆舟」，麻醉藥帶來的風險實在不容忽視。過量的鎮靜及止痛藥物能令病人轉迅間失去知覺，停止呼吸；而過量的麻醉藥亦可引起併發症如痙攣，心臟停頓等；若未能及早發現和提供適當的治療；嚴重的可引致死亡。麻醉專科醫生的職責，就是讓病人安全地接受手術和檢查。在香港要成爲麻醉專科醫生，需要在醫科畢業後接受六年的專科培訓和通過三重專業考試，才能取得有關專業資格。本港執業的麻醉專科醫生均在醫務委員會的專科名冊上登記。

雖然至今尚未有法例規管使用上述藥物的人士必需持有特定的專業資格，但我們認爲任何人士在使用麻醉、鎮靜及止痛藥物的時候，必需注意以下幾點：

(一) 充分了解麻醉藥的藥性和使用方法
(二) 爲病人作麻醉前檢查和風險評估
(三) 有受過適當訓練包括急救的專職醫護人員在旁負責監察病人的狀況
(四) 備有充足的急救器材和藥物

香港麻醉科醫學院及其他專業團體對小型手術和檢查施行鎮靜的安全守則提供了清晰的指引，詳情可瀏覽香港麻醉科醫學院網頁 (http://www.hkca.edu.hk)。病人亦有權清楚了解麻醉的性質，若有疑問可向你的醫生或任何麻醉專科醫生查詢。

香港麻醉科醫學院
香港麻醉科學會

二 OO 六年三月一日

查詢：香港麻醉科醫學院辦公室 (電話: 28718833)

Peter Kam's Courses ….

(First announcement)

REVISION TUTORIAL COURSE IN ANAESTHESIOLOGY 2006

This year Professor Peter Kam will again be running two REVISION TUTORIAL COURSES:

	Basic science in Anesthesiology	***Clinical Anaesthesiology***
Time	20 November - 1 December, 2006	2 December - 9 December 2006
Contents	2 weeks "fulltime" course containing lectures, tutorials and mock viva	7½ -day course with interactive lectures, tutorials and mock viva sessions
Target audience	Trainees preparing for the Intermediate Fellowship Examination	Trainees preparing for the Final Fellowship Examination
Venue	Queen Elizabeth Hospital	
Maximum number	30	30
Fee	HK$ 2,000 Registered HKCA trainee HK$ 4,000 for non-HKCA member	HK$ 1,500 Registered HKCA trainee HK$ 3,000 for non-HKCA member
Deadline for application	4 November, 2006	11th November 2006

Details are subjected to change without prior notice.
If you have any queries concerning the course, please contact Mr. Daniel Tso, Administrative Executive at 2871 8833. Further information can also be obtained at the College website www.hkca.edu.hk.

Drs CH KOO and Douglas FOK,
Course Coordinators, Department of Anaesthesia, Queen Elizabeth Hospital

Board of Pain Medicine

Current Diploma of Pain Management Training Status

Hospital	Number of training posts	Supervisor of Training	Current Trainees as at 1 June 2006
QMH	2	Libby Lee	HT Chan Leo Sin
QEH	1	Theresa Li	Tony Cheng
NTE	2	MC Chu	Peggy Pang Michelle Cheung
UCH	1	Tim Brake	Sunny Lee
PYNEH	1 (for 6 months)	SK Kong	Vacant

At the recent Board of Pain Medicine meeting in May 2006, the subcommittees on the review of training and examination for the Diploma of Pain Management, chaired by Drs MC Chu and TW Lee respectively, have reported to the Board on the final recommendations for changes to be made on the curriculum and examination. Once the changes have been approved by Council, the Board will announce them to all Supervisors of training, members and fellows. It is envisage that the curriculum and format of examination will be revised from 2008.

Dr PP Chen
Chairman
Board of Pain Medicine

Board of Examination

Intermediate Fellowship Examination February/March 2006

CHENG, King Lik
CHOY, Chung Ming, Eric
IP, Ka Ho
NG, Lai Ming
TANG, Kin Bong
WONG, Sze Ming

Six out of 9 candidates passed the examination.
The College is grateful to Dr. Susan Hill of RCA, and Professor Duncan Blake of ANZCA for their assistance as External Examiners during the examination.

Examiners of the Intermediate Examination
From Left to right: Drs Jackie Yap, KK Lam (Chairman), Professor Warwick Ngan Kee, Professor Duncan Blake, Drs Susan Hill, WH Kwok, CK Koo, Andrew Wong, Gordon Jan

Final Fellowship Examination March/May 2006

CHAN, Choi Hung
CHAN, Kwok Bun
FUNG, Chi Sum Winnie
HUSSAIN, Assad
LEE, Ka Yee
LEE, Yee Chi
LEUNG, Ka Ki
LEUNG, Yin Yee
LI, Tze Yan
LO, Chor Kwan
LUI, Frances
YEUNG, Lok See

Twelve out of 20 candidates passed the examination. The HKCA Final Fellowship Examination Prize was awarded to Dr LEE, Ka Yee of Prince of Wales Hospital.
The College is grateful to Dr. Mark Heining of RCA, and Dr. Glenda Rudkin of ANZCA for their assistance as External Examiners during the examination.

Dr PT Chui
Chairman
Board of Examination

ANNUAL SCIENTIFIC MEETING IN ANAESTHESIOLOGY 2006

ASM 2006

18-19 November 2006

Hong Kong Convention and Exhibition Centre

The Scientific Committee of the Annual Scientific Meeting in Anaesthesiology 2006 cordially invites you to submit abstracts for oral presentations. A prize will be awarded for the best trainee abstract presented at the meeting. Regulations can be found in the web site:
http://www.hkca.edu.hk

Notes:

(a) Deadline for submission of abstracts: 15 August 2006

(b) All abstracts must be accompanied by payment of the appropriate registration fee.

JOINTLY ORGANIZED BY:

The Hong Kong College of Anaesthesiologists

The Society of Anaesthetists of Hong Kong

Workshop in

Airway Management for Nurses

Organized by

The Hong Kong College of Anaesthesiologists

Institute of Clinical Simulation

North District Hospital

Aim :	To enhance the knowledge and skill in airway management
Target Participant :	All Nurses
Date :	20 May 2006 or 16 September 2006 or 18 November 2006
Time :	08:30AM - 12:30PM
Venue :	ICS, 3/F, North District Hospital
Workshop Design :	Lecture, Video, Skill Stations
Course fee:	HK$ 300.00
Accrediation :	3.5 CNE points
Class Capacity :	16 Persons
Enquiry :	College Secretariat at 28718833 Mr. Alick Chiu DOM (OT & SSD) NDH at 26838085

Application form can be downloaded from

The Hong Kong College of Anaesthesiologists Intranet www.hkca.edu.hk or

Department of Anaesthesiology & Operating Services NDH Intranet

The Institute of Clinical Simulation

(Collaboration with the Hong Kong College of Anaesthesiologists and North District Hospital)

Crisis Resource Management for Nurses

CRMN 2006

Aim to update and enhance skills and knowledge on Crisis Resource management

Target participant:	**All nurses working in Operating Theatre**
Date:	**19 August 2006 (Saturday)**
Time:	**09:00-17:00**
Venue:	**Institute of Clinical Simulation, 3/F North District Hospital**
Accrediation:	**CNE 7 points** **Certificate will be issued after successful completion of the course**
Class capacity:	**8 participants per class**
Course fee:	**HK 800 per participant**

Course content:

- **Lectures on 'Theories in Crisis Resource Management' & 'Communication' .**
- **Introduction to the METI Clinical Simulator and it's application in the workshop.**
- **Simulated clinical scenarios management.**
- **Debriefing sessions to allow reinforcement and integration of the skills learned in the simulated scenarios.**
- **Demonstration on the preparation and care of fiberoptic bronchoscope**
- **Practical session on fibreoptic bronchoscopy using "Virtual Bronchoscopy Model".**
- **Simulated skill stations.**

clinical crisis scenarios will be videotaped for debriefing purpose.
all participants are required to sign a confidentiality statement.

Registration will be on first come first served basis.

For enquiries, please Contact Course Coordinator Mr. Alick Chiu DOM (OT&SSD) NDH at 2683 8085 or College Secretariat at 2871 8833.

Application form and course information can be downloaded from

the Hong Kong College of Anaesthesiologists Intranet www.hkca.edu.hk or

Department of Anaesthesiology & Operating Services NDH Intranet

Management of Anaesthetic Crisis (EMAC) course

(Accredited by the Australian and New Zealand College of Anaesthetists)

EMAC is a simulator-based course catered to management of anaesthetic crises developed by Australian and New Zealand College of Anaesthetists. It is comprised of 5 half-day modules, namely Human Performance, Cardiovascular Emergencies, Airway, Anaesthetic Emergencies and Trauma.

Venue:	**Institute of Clinical Simulation** **North District Hospital** **9 Po Kin Road, Sheung Shui**
Date:	**21-23 October 2006** **0800 hr to 1700 hr on 21 and 22 October, 2006** **0800 hr to 1230 hr on 23 October, 2006**
CME points:	**HKCA 20 points**
Max participants:	**8**
Fee:	**HK$4,000 per head**
Format:	**Each registrant will participate in:** **(1) Lectures** **(2) Skills stations** **(3) An introduction on the METI Simulator, the anesthetic machine for use in the workshop and the theories of crisis management** **(4) Allocated time for hands-on crisis scenario management on the METI Simulator, rotating through different roles and handling different scenarios**

Trainees starting training program on or after 1st January 2005 are required to complete the EMAC course or its equivalent.

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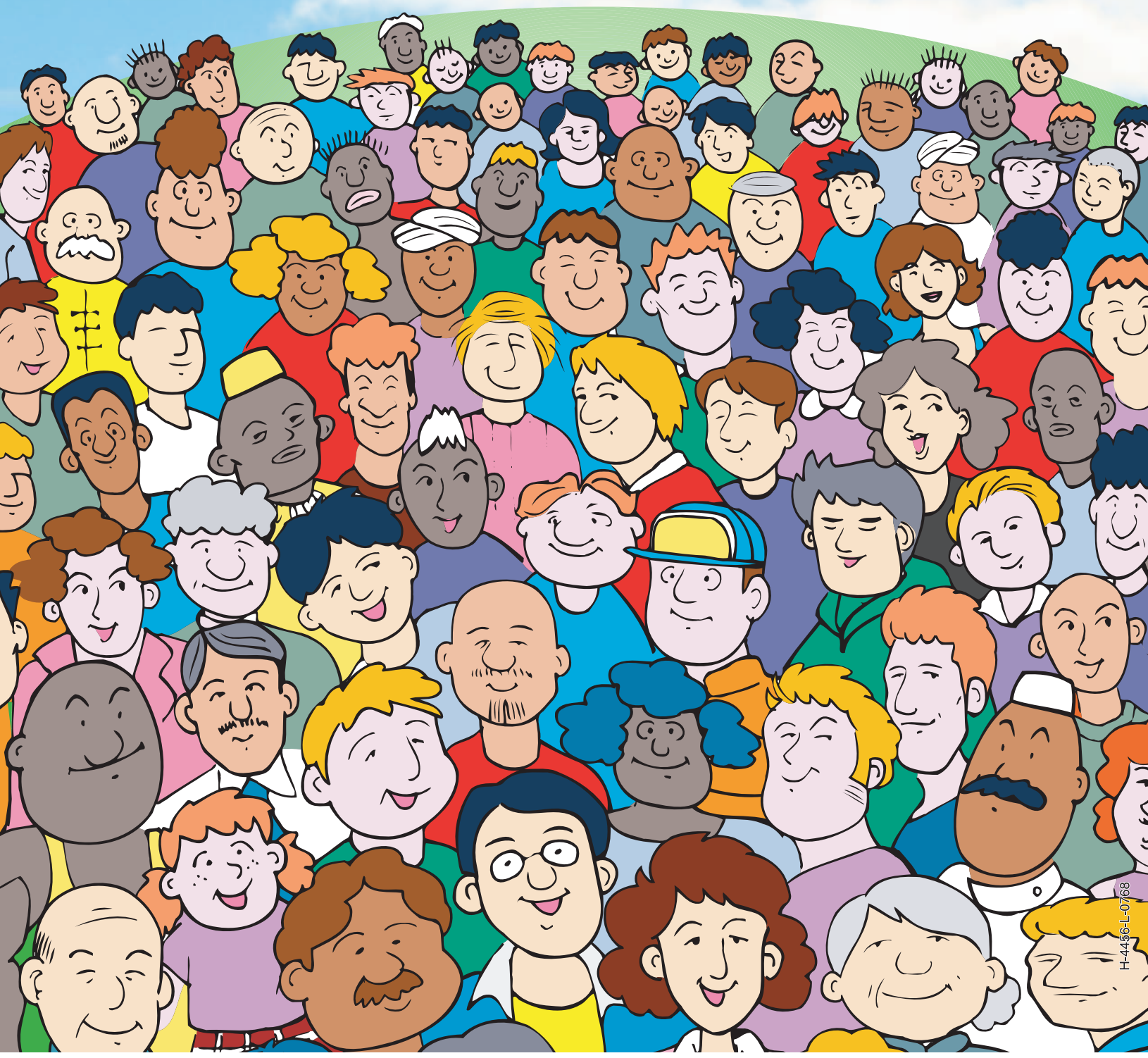

H-4456-L-0768

* Based upon Abbott in-house data, as of Nov. 2003.

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  - o Train-Of-Four
  - o Tetanic Stimulation
  - o Post Tetanic Count
  - o Double Burst Stimulation

Reference:
1. Wierda et al., Br J Anaesth 1990;64:521-3.
2. Chetty M et al., Anaesth Intens care 1996;24:37-41.
3. J. C. De mey et al., Eur J Anaesthesiol 1994;37-40.
4. Schramm et al., Br J Anaesth 1996;77:607-11.
5. Naguib et al., Br J Anaesth 1995;75:588-92.
6. Scott et al., Anaesthesia 1998;53:867-71.
7. Schramm et al., Acta Anaesthesiol Scand 1998;42(Suppl 112):233-5.
8. Calon B et al., Data on file.
9. Prielipp RC et al., Anesth Analg 1995;81:3-12.
10. Strange C et al., Am J Respir Crit Care Med 1997;156:1556-61.
11. Khuenl-Brady et al., Eur J Anaesthesiol 1995;12(Suppl 11):79-80.
12. Approved Product information

HK.05.ESM.01

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	Yu Fat CHOW
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	Chi Hung KOO
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	John LIU

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Matthew Chan (*Deputy Officer*)

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Agnes Cheng	

Organizer, Basic Science Course: CH Koo, Aaron Lai
Organizers, Clinical Anaesthesiology Courses (Informative course and Crash course): Douglas Fok and Eric So
Chairman, The Institute of Clinical Simulation: KM Ho (Chairman)