

Anaesthetic Management in Hyperthermic Intraperitoneal Chemotherapy (HIPEC) in a Tertiary Care Institution in Southeast Asia: A Retrospective Review

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Background

- Cytoreductive surgery (CRS) combined with hyperthermic intraperitoneal chemotherapy (HIPEC) has become a cornerstone of treatment of peritoneal-surface malignancies.
- It is a complex procedure involving elaborate anaesthetic techniques.

Aims

- Given the local scarcity of data pertaining to HIPEC, our aim was to retrospectively review HIPEC cases from the years 2015-2017 in a tertiary care institution in Singapore (Singapore General Hospital, SGH).
- In doing so, we hoped to gain insights into the nature of anaesthesia in HIPEC.

Methods

- Data on patient characteristics, intra-operative management and post-operative course were collected from electronic patient records.
- A total of 113 patients underwent 118 CRS/HIPEC interventions in the designated time period of 2015 to 2017.
- There were no exclusion criteria.

Results

- Pre-operative data is presented in Table 1.
- 67.7% of patients were females
- Median age: 57 years old.
- Most common co-morbidity: Cardiovascular (53.3%)
- Other common co-morbidities: Endocrine conditions, obesity.
- Most common primary cancer sites: Colorectal, appendix and ovary.
- Many had undergone previous cancer treatment in the form of surgical resection, chemotherapy or radiotherapy.
- 5 patients who underwent repeat CRS/HIPEC within 1-2 years for primary tumour recurrence.

Table 1: Pre-Operative Data

Parameter	Value
Age (years)	Median 57, (19-76)
Gender (M:F)	38:80
BMI (kg/m ²)	Median 23, (11.6-46.4)
ASA Class I/II/III	5, 72, 41
Comorbidities	
Cardiovascular	63
Pulmonary	7
Renal	6
Endocrine	25
Neurological	3
Obesity	22
Origin of Primary Cancer	
Appendix	31
Ovary	18
Colorectal	44
Mesothelioma	3
Gastric	4
Peritoneum	5
Not stated	5
Pre-Cancer Treatment	
Surgery	84
Chemotherapy	62
Radiotherapy	6

Table 2: Intra-Operative Data

Parameter	Value
Anaesthesia Time (min)	Median 455 (202 – 857)
Operation Time (min)	Median 402 (181 – 819)
Additional thoracic epidural anaesthesia (TEA)	2
Anaesthesia induction	
Propofol	118
Ketamine	20
Etomidate	1
Analgesic agents	
Fentanyl	30
Remifentanyl	93
Morphine	109
Paracetamol	80
Lignocaine	41
Paralytic agents	
Suxamethonium	5
Atracurium	109
Rocuronium	41

- Intra-operative data are presented in Table 2.
- Anaesthesia induction was typically performed with propofol, along with a neuromuscular agent (e.g. atracurium).
- Anaesthesia maintenance was achieved via volatile agents (e.g. desflurane, sevoflurane).
- Analgesic agents were administered where appropriate – most common agent used was morphine.
- Additional thoracic epidural anaesthesia was performed in 6.8%; this was associated with a reduced morphine dose per kg (p-value = 0.0034).
- Post-operative data are presented in Table 3.
- Median length of hospital stay: 12 days (range 6 to 91).
- Increased duration of hospital stay was observed with increased respiratory (p-value 0.0126) and neurology (p-value 0.0371) comorbidities.
- Increased operation time (p-value 0.0310) and increased anaesthesia time (p-value 0.0162) were also associated with increased hospital stay duration.
- 40 patients required ICU stay - median 1 day (range 1-10)
- Of the 40 patient, 50% required only one day of ICU stay.

- Patients with additional TEA tended to have a longer ICU stay (p-value 0.0017).
- Increased anaesthetic duration (p-value 0.0285) was associated with longer ICU stay.
- 25 patients required post-operative mechanical ventilation - median 1 day (range 1-7).
- Of the 25 patients, 21 required only one day of mechanical ventilation.
- Length of post-operative mechanical ventilation is increased when there is increased intra-operative morphine use (p-value 0.0003), increased blood products input (p-value 0.0049), increased operation time (p-value 0.0003) and increased anaesthesia duration (p-value 0.0010).
- Surgical complications were graded according to the Clavien-Dindo classification.
- Major surgical complications (grade 3-4) occurred in 7 patients.

Table 3: Post-Operative Data

Parameter	Value
Length of Hospital Stay	Median 12 (6-91)
Transfer to ICU	40
Length of ICU Stay	Median 1 (1-10)
Mechanical Ventilation Required	25
Length of Mechanical Ventilation	Median 1 (1-7)
Clavien Dindo Classification	
Grade 1	50
Grade 2	3
Grade 3	4
Grade 4	0
Grade 5	0

Discussion

- 8 patients underwent additional TEA.
- Chief advantage of using TEA: Reduction in the doses of opioids necessary to maintain optimum pain control (1)
- Nonetheless, our analysis also shows that there is an increase in the duration of postoperative recovery in patients who were subjected to epidural analgesia.
- This could be due to several disadvantages of epidural agents: alterations in the patient's hemodynamic status, thereby affecting accuracy of hemodynamic monitoring and fluid management; risks of bleeding and hematoma formation; prolonged operative and anaesthesia time in view of additional logistical concerns, which could in turn delay post-operative recovery.
- Nevertheless, there is emerging evidence that epidural analgesia could be used as a safe adjunct to traditional anaesthesia techniques in HIPEC (2).
- Length of hospital stay post-operatively ranged widely from 6 to 91 days.
- Principal hindrances to recovery: Post-operative infections, bleeding and anastomotic leaks.
- 3 patients developed sepsis requiring intensive care.
- Similar to patients with other intra-abdominal surgical procedures, patients undergoing CRS and HIPEC are at risk for bowel perforations, anastomotic leakage, post-operative bleeding, wound dehiscence, deep vein thrombosis and pulmonary embolism (3).
- The most frequently used drug in HIPEC for pseudomyxoma peritonei, mitomycin C, affects wound healing and results in an increased incidence in anastomotic leaks, especially in patients treated pre-operatively with radiation therapy (4).
- In anticipation of these post-operative circumstances, all patients undergoing CRS and HIPEC should be admitted to the intensive care unit, intermediate care area or high-dependency unit, for monitoring of organ function, management of intraoperative complications and correction of coagulopathy (5).
- Despite the prolonged post-operative recovery period in some of the patients, no deaths (i.e. grade 5) occurred during in the immediate post-operative period, and all patients studied were discharged well and stable.
- This is likely due to the stringent criteria for patient selection (6) for the procedure, with many suitable patients being relatively young with few comorbidities (7).

Conclusion

- This review has shown that several factors such as primary disease, anaesthesia management, and amount of blood transfusions have a significant effect on patients' outcome.
- HIPEC is an intricate procedure involving complex surgical techniques and anaesthetic management and can be associated with significant morbidity and mortality.
- Nonetheless, if successful, it is associated with high 5-year survival rates and good outcomes (8) and it is an expanding field with exciting room for further refinement and development of existing practices.

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