Use of Intraoperative Salvaged Blood filtered with Leucocyte Depletion Filter (LDF) in Metastatic Spine Tumour Surgery (MSTS)

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Disclosures & Acknowledgments

• Disclosures – None

• **Prof Wong Hee Kit** (Mentor & Guide)
• Aye Sandar Zaw, Yongsheng Chen
• Qasim Ahmed & Victor Lee (Pathologists)
• Raymod Goy & Rohit Agawaral (Anaesthetists)

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Blood loss in Metastatic Spine Tumor Surgery (MSTS)

• **Vertebral column** - commonest site of metastasis

• **MSTS** is associated with **significant blood loss.**
  - N Kumar et al. Am J Orth, June 2012

• **Meta-Analysis** recently conducted by our group:
  • pooled mean blood loss during MSTS - **2180ml**
  - represents **> 1/3 of the circulating blood volume.**
  - Y Chen et al. JBJS [Br] – 95 (5) – May 2013
Allogeneic Blood Transfusion (ABT)

- **ABT** is still-
  - the **mainstay** for replenishing blood lost
  - **undue strain** on limited blood bank resources

- Increasing awareness of the **deleterious effects of ABT**
- **especially in** cancer surgery
  - post-operative infection
  - promotion of tumour growth
  - secondary to **immunosuppression**
  - transfusion **reactions**
Intra-operative Cell Salvage (IOCS)

- **Established** in non-tumour related spinal surgery

- **Contraindicated** in tumour surgery
  - theoretical concern of re-infusing malignant cells
  - promoting tumour dissemination

- The American Medical Council’s report on
  - ‘Autologous Blood Transfusions’ of 1986 stated
    - IOCS was **contraindicated in malignancy**
Systematic Review

Comprehensive search of the English literature

- Medline
- Embase
- The Cochrane Central Register of Controlled Trials
- Web of Science

• articles published
  • between 1 January 1986 and 31 Dec 2012.

- **Question 1:** Has IOCS ever been used in MSTS?

- **Question 2:** Is there any evidence supporting the use of IOCS in oncologic surgeries in other surgical specialties?
– **Question 1**: Has IOCS ever been used in MSTS?

**IOCS HAS NEVER BEEN USED IN MSTS**

– **Question 2**: Is there any evidence supporting the use of IOCS in oncologic surgeries in other surgical specialties?

The use of IOCS-LDF has been extensively investigated in a number of oncological surgeries

(Gynaecology, Hepatobiliary, Gastrointesinal, Urology and Lung)
Conclusions of Systematic Review

✓ IOCS - LDF can **remove tumour cells** from salvaged blood.

✓ **IOCS** in patients undergoing cancer surgery –
  ✓ not associated with any adverse clinical outcomes.

✓ **IOCS** → **reduce ABT requirements** significantly in
  ✓ gynaecological
  ✓ hepatocellular
  ✓ gastrointestinal
  ✓ urological cancer surgery.

— **N Kumar et al** Lancet Oncology, Jan 2014
Leucocyte Depletion Filter (LDF)

• **Commonly used by haematologists**
  – in treatment of leukaemias / neutropaenic patients
  – to reduce transfusion reaction

• **Emerging evidence in literature**
  – in addition to filtering out WBCs
  – LDF can also remove tumour cells.
Our Prospective Observational Study

First ever study on IOCS use in Metastatic spine tumour surgery (MSTS)
Research Aims

• To investigate whether combination of cell saver and leucocyte depletion filter can remove tumour cells from blood salvaged during MSTS.

Study design

➢ Prospective observational Study (Non-reinfusion study)

➢ Obtained ethical approval from Institutional Review Board
Participants – Inclusion

- Known epithelial primary origin (Breast, prostate, renal, lung, colorectal, nasopharyngeal)
- Medically and physically fit for surgery
- Requiring spinal surgery
- \( N=40 \)
- Age \( \geq 21 \)
Stages of Blood Collection

- **Stage A**: 15 ml directly from operative field
- **Stage B**: 15 ml Salvaged blood after IOCS
- **Stage C**: 15 ml Salvaged blood after IOCS and LDF

**Intraoperative Cell Salvage (IOCS)**

**Leucocyte depletion filter (LDF)**
Sample processing

Sample obtained

Stained with highly sensitive immunostains (cytokeratins AE1/3, MNF116 and CAM 5.2) to identify epithelial tumour cells

Read by Two Consultant Pathologists
Tumour cells in the sample taken before cell saver processing
## Results

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<th>Serial No.</th>
<th>Sex</th>
<th>Age</th>
<th>Primary Tumour</th>
<th>Location of Tumour</th>
<th>Stage A</th>
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</table>
Key Finding

✓ No viable malignant cells after cell saver and LDF

✓ 4 cases remained positive for tumour cells after cell saver processing

✓ 16 cases remained positive for tumour cells before cell saver processing
Conclusion

- **Cell saver alone**
  - remove tumour cells in \(>90\%\) of specimens

- **+ LDF**
  - complete elimination of tumour cells in all specimens

- propose to extend the study to
  - whole musculoskeletal oncology in future
Use of intraoperative cell-salvage for autologous blood transfusions in metastatic spine tumour surgery: a systematic review

Naresh Kumar, Yongsheng Chen, Aye S Zaw, Deepi Nayak, Qasim Ahmed, Richie Soong, Hee Kwong

Metastatic spine tumour surgery (MSTS) and metastatic musculoskeletal tumour surgery (MMTS) are associated with substantial blood loss. Allogeneic blood transfusion is the present method used to replenish this blood. Intraoperative cell salvage (IOCS) is a viable alternative, but is contraindicated in tumour surgery because of the risk of tumour dissemination. Use of IOCS—leucocyte depletion filter (LDF) allows removal of tumour cells from blood salvaged during oncological surgery. However, no reports exist on use of IOCS in MSTS or MMTS. We systematically reviewed studies on IOCS in oncological surgery to investigate whether sufficient evidence exists to support its use in MSTS or MMTS.

Introduction
Skeletal metastatic disease could be regarded as a new epidemic. Nearly half of patients with cancer will develop skeletal metastases in their lifetime. Although metastases can be symptomatic, skeletal metastases are the most prevalent, leading to approximately 40% of skeletal-related events. In patients with prostate cancer, the vertebral column is the most common site of bone metastasis. Results of studies have suggested that 30–90% of patients with cancer have spinal metastasis. Similar to bone metastases elsewhere in the body, the most common primary cancers that metastasize to the spine are prostate, breast, lung, and multiple myeloma. The challenges posed by skeletal metastases are not limited to the patient, but impact on the healthcare system. As such, the development of new techniques that are effective, efficient, and cost-effective for the management of metastatic disease is crucial.

Oncology
Blood loss in spinal tumour surgery and surgery for metastatic spinal disease: a meta-analysis


From National University Health System, Singapore

There is currently no consensus about the mean volume of blood lost during spinal tumour surgery and surgery for metastatic spinal disease. We conducted a systematic review of papers published in the English language between 31 January 1992 and 31 January 2012. Only papers that clearly presented blood loss data in spinal surgery for metastatic disease were included. The random effects model was used to obtain the pooled estimate of mean blood loss.

We selected 18 papers, including six case series, ten retrospective reviews and two prospective studies. Altogether, there were 760 patients who had undergone spinal tumour surgery and surgery for metastatic spinal disease. The pooled estimate of peri-operative blood loss was 2180 ml (95% confidence interval 1805 to 2554) with catastrophic blood loss as high as 5000 ml, which is rare. Aside from two studies that reported large amounts of mean blood loss (> 5500 ml), the resulting funnel plot suggested an absence of publication bias.