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Clinical Significance of Pre-operative Embolization for Non-hypervascular Metastatic Spine Tumors

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Introduction

- Efficacy of preoperative embolization for **hypervascular metastatic spine disease (MSD)** such as renal cell and thyroid cancers has been reported.

- Debate on the efficacy of preoperative embolization for **non-hypervascular MSD** still remains unsettled.

To evaluate **efficacy of preoperative transarterial embolization** in ***non-hypervascular MSD*** and **the vascular safety of the spinal cord.**

Methods

- **Patients population**
  - **Retrospective cohort study from 2011 to 2016**
  - **<u>Inclusion criteria</u>**
    - Adult patients diagnosed with metastatic spine lesion
    - Treatment with reconstructive surgery
  - **<u>Exclusion criteria</u>**
    - Metastatic spine lesion with highly vascular tumor such as renal or thyroid carcinoma
    - Combined surgery for non-spinal metastatic tumors
- **Three types of surgery**

1) Posterior laminectomy and excision of tumors with posterior reconstruction (n=41)
2) Posterior vertebral column resection (PVCR) with posterior reconstruction (n=22)
3) Anterior corpectomy with anterior or posterior reconstruction (n=16)

Methods

- **Parameters**
  - General condition (Revised Tokuhashi score)
  - Instability of the spine (Spinal Instability Neoplastic Score; SINS)
  - Location of the main lesions and history of radiation therapy

- **Estimated blood loss (EBL)**

1) Intraoperative EBL: amount of suction drainage and soaked by gauze
2) Perioperative EBL: amount of drain for postoperative 2 days
3) Calibrated EBL: [(preoperative hemoglobin – hemoglobin on postoperative 2^{nd} day) + total number of transfused red blood cell (PRC)]

Results

- **Demographics**
  - 79 patients (Male : female = 50 : 29)
  - Mean age: 57.6 ± 13.5 years
  - 5 cervical, 53 thoracic and 21 lumbosacral spines
  - Primary cancer
    - Lung (30, 38.0%)
    - Hepatocellular (14, 17.7%)
    - Gastrointestinal (9, 11.4%)
    - Others (26, 32.9%)
  - Mean fusion levels: 3.9 ± 1.5

Pre-operative embolization

- 36 patients (45.6%)
- Conducted within 48 hours prior to surgery
- Mechanical coil (Tornado® or Vortx®, Cook medical, Bloomington, IN)

Results

- **Demographics of the patients between the two groups.**

	Non-embolization (n=43)	Embolization (n=36)	*P* value
Age (years)	58.7 ± 13.4	56.1 ± 13.6	0.395
Sex (M: F)	30 : 13	20 : 16	0.192
Primary			
Lung	16	14	
HCC	7	7	
GI	5	4	
others	15	11	
Number of instrumented levels	4.1 ± 1.5	3.7 ± 1.3	0.177
BMD (T-score)	-2.5 ± 1.1	-2.3 ± 1.4	0.623
ASA grade (1, 2 : 3, 4)	36 : 7	29 : 7	0.714
Revised Tokuhashi score	7.9 ± 2.5	6.5 ± 2.2	0.111
SINS	10.4 ± 2.6	10.1 ± 3.3	0.815

HCC, hepatocellular cancer; GI, gastrointestinal; BMD, bone mineral density; ASA, American Society Anesthesiologists physical status classification; SINS, spinal instability neoplastic score

Results

- **Operation time and EBL between embolization and non-embolization groups.**

	Non-embolization (n=43)	Embolization (n=36)	*P* value
Operation time (min)	219.9 ± 77.7	231.9 ± 79.9	0.501
Intraoperative EBL (mL)	1069.8 ± 869.7	862.5 ± 526.2	0.215
Perioperative EBL (mL)	529.0 ± 287.3	513.9 ± 415.6	0.849
N. of transfused PRC	4.1 ± 2.8	3.7 ± 2.2	0.540
Cal. EBL (g/dL)	5.5 ± 3.1	4.9 ± 3.3	0.420

EBL, estimated blood loss; PRC, packed red blood cells; Cal. EBL, calibrated estimated blood loss

Results

- **The effect of embolization on operation time and estimated blood loss according to type of surgery.**

	Corpectomy (n=38)			Laminectomy (n=41)		
	Non-embol (n=11)	Embol (n=27)	*P* value	Non-embol (n=32)	Embol (n= 9)	*P* value
Operation time (min)	276.3 ± 89.3	243.9 ± 88.4	0.314	200.5 ± 63.9	196.0 ± 24.5	0.838
Intraoperative EBL (mL)	1645.5 ± 1277.8	892.6 ± 589.0	**0.017**	871.9 ± 583.1	772.2 ± 268.2	0.624
Perioperative EBL (mL)	569.7 ± 378.5	555.3 ± 454.4	0.927	515.0 ± 254.6	389.6 ± 247.7	0.197
N. of transfused PRC	6.1 ± 2.9	3.9 ± 2.2	**0.018**	3.3 ± 2.4	3.0 ± 2.2	0.698
Cal. EBL (g/dL)	7.5 ± 3.4	5.5 ± 3.5	0.117	4.8 ± 2.7	3.1 ± 1.6	0.084

EBL, estimated blood loss; PRC, packed red blood cells; Cal. EBL, calibrated estimated blood loss

Results

- **Clinical significance of the artery of Adamkiewicz**
  - 2 patients with anterior artery through the Adamkiewicz artery

    → **Embolization was not performed**

  - Disruption of this major feeder artery

    → **Significant changes in intraoperative neuromonitoring**

Limitations

- **Heterogeneous primary sites of cancer**
  - Limited number of MSD treated with the surgery
  - Non-hypervascular tumors other than highly vascular tumors

- **Clinical outcomes such as pain and functional status were not evaluated.**
  - Influenced by uncontrolled factors such as general conditions, activity of tumor or other concurrent metastasis

Conclusions

- **Preoperative embolization for non-hypervascular MSD** other than renal and thyroid cancer failed to reduce perioperative blood loss in this study

- **Embolization** significantly decreased intraoperative bleeding and total transfusion **in the corpectomy group.**

- **Preoperative embolization** provides anatomic insights for the surgeon to avoid **vascular compromise of the spinal cord.**