Poster No. 10.05

International Surgical Week
The World's Congress of Surgery
isw2024.org
Kuala Lumpur, Malaysia
25-29 August 2024

Preoperative Tattoo Localization of Recurred Differentiated Thyroid Carcinoma Utilizing Charcoal and Indigocarmine

Woochul Kim[1], Su Jin Kim[1], Seung Ho Lee[1], Hye Lim Bae[1], Ji Ye Lee[2], Jung Hee Kim[3], Ji Hun Kim[2], Jae Kyung Won[4], Kyu Eun Lee[1]

[1] Department of Surgery, Seoul National University Hospital & College of Medicine, Seoul, Korea
[2] Department of Radiology, Seoul National University Hospital & College of Medicine, Seoul, Korea
[3] Department of Internal Medicine, Seoul National University Hospital & College of Medicine, Seoul, Korea
[4] Department of Pathology, Seoul National University Hospital & College of Medicine, Seoul, Korea

Introduction

- The recurrence rate of DTC varies widely (3% to 68%) based on associated risk factors.
- Re-operating on recurrent DTC is challenging due to adhesions and the loss of clear surgical planes.
- In the absence of precise lesion localization, extensive surgery may be necessary to achieve completeness, prolonging operation times and increasing post-operative complications.
- Notably, failure to identify recurrent lesions in final pathology often requires additional surgeries.
- Pre-operative tattooing of recurrent lesions, facilitated by experienced radiologists, can assist surgeons in precise localization, potentially improving surgical outcomes and reducing post-operative complications.

Materials and Methods

- 110 patients with DTC who underwent tattoo localization between May 2013 and December 2023
- Surgeons chose either Charcoal or Indigocarmine ink for injection at the site of the recurrent lesion just before surgery, based on preference
- Surgical success initially relied on the complete removal of all ink-colored lymph nodes and lesions
- Outcomes assessed based on two main criteria: (1) the complete removal of recurrent lesions (2) the occurrence of post-operative complications
- Completeness of surgery determined by analyzing post-operative pathology, with additional evaluations of biochemical markers and radiological findings.

Results

Table 1. Patient Characteristics

	All (n=110)	Charcoal (n=70)	Indigocarmine (n=40)
Sex			
Male	34 (30.9%)	26 (37.1%)	8 (20.0%)
Female	76 (69.1%)	44 (62.9%)	32 (80.0%)
Median Age at Tattooing (years)	48.45 (21-83)	48.44 (21-83)	48.48 (21-75)
No. of Previous Operations			
1	85 (77.3%)	52 (74.3%)	33 (82.5%)
2	13 (11.8%)	10 (14.3%)	3 (7.5%)
3	9 (8.2%)	3 (4.3%)	6 (15.0%)
4	3 (2.7%)	2 (2.9%)	1 (2.5%)
Extent of previous operation			
Lobectomy	1 (0.9%)	1 (1.4%)	0
Subtotal thyroidectomy	2 (1.8%)	2 (2.8%)	0
Total thyroidectomy	107 (97.3%)	67 (95.8%)	40 (100.0%)
Extent of Previous CND			
Not done	1 (0.9%)	1 (1.4%)	0
Unilateral central neck dissection	11 (10.0%)	11 (15.7%)	0
Bilateral central neck dissection	98 (89.1%)	58 (82.9%)	40 (100.0%)
Extent of Previous LND			
Not done	64 (58.2%)	39 (55.7%)	25 (62.5%)
Unilateral SND or mRND	37 (33.6%)	25 (35.7%)	12 (30.0%)
Bilateral SND or mRND	9 (8.2%)	6 (8.6%)	3 (7.5%)
No. of previous RAI therapy			
0	16 (14.5%)	9 (12.9%)	7 (17.5%)
1	37 (33.6%)	21 (30.0%)	16 (40.0%)
2	37 (33.6%)	25 (35.7%)	12 (30.0%)
>3	20 (18.2%)	15 (21.4%)	5 (12.5%)
Total RAI dose (mCi)	192.9 (0-1750)	208.9 (0-1750)	165.0 (0-1750)
No. of Tattooing mass			
1	58 (57.2%)	34 (48.6%)	24 (60.0%)
2	32 (29.1%)	22 (31.4%)	10 (25.0%)
3	12 (10.9%)	9 (12.9%)	3 (7.5%)
4	5 (4.5%)	3 (4.3%)	2 (5.0%)
5	2 (1.8%)	2 (2.8%)	0
6	1 (0.9%)	0	1 (2.5%)
Total no. of tattooing lesions	194	127	67

Table 2. Surgical completeness assessed by pathological and biochemical outcomes

	Charcoal tattooing mass (n=127)	Indigocarmine tattooing mass (n=67)	*p*
Location			*0.861*
Level Ib	1 (0.8%)	0	
Level II	15 (11.8%)	9 (13.4%)	
Level III	10 (7.9%)	5 (7.5%)	
Level IV	18 (14.2%)	11 (16.4%)	
Level V	6 (4.7%)	4 (6.0%)	
Level VI	76 (59.8%)	36 (53.7%)	
Level VII	1 (0.8%)	2 (3.0%)	
Median size of mass (cm, IQR)	0.79 (0.3-1.74)	0.94 (0.3-2.1)	*0.271*
Positive predictive value (no. of remnant lesion†/no. of tattooing lesion)	110/127 (86.6%)	59/67 (88.1%)	*0.952*
No. of cases with decreased serum Tg levels*	68 (97.1%)	39 (97.5%)	*1.000*

†The remnant lesion means that the lesions founded identically at imaging modalities before and after revision surgery
***Number of patients as denominator**

Table 3. Operative outcomes and surgery related complications

	All (n=110)	Charcoal (n=70)	Indigocarmine (n=40)	*p*
Hospital Stay (days)	2.4 (1-7)	2.4 (1-7)	2.3 (1-4)	*0.591*
Total drain amount				*0.083*
No drain	32 (29.1%)	16 (22.9%)	16 (40.0%)	
≤100ml	53 (48.2%)	39 (55.7%)	14 (35.0%)	
>100ml	25 (22.7%)	15 (21.4%)	10 (25.0%)	
Operation Time				*1.000*
≤90min	49 (44.5%)	31 (44.3%)	18 (45.0%)	
>90min	61 (55.5%)	39 (55.7%)	22 (55.0%)	
Operation Time (min)	108.5 (25-298)	110.6 (25-298)	104.8 (45-215)	*0.583*
Chyle Leak				*1.000*
No	108 (98.2%)	69 (98.6%)	39 (97.5%)	
Yes	2 (1.8%)	1 (1.4%)	1 (2.5%)	
Bleeding				*0.736*
No	108 (98.2%)	68 (97.1%)	40 (100.0%)	
Yes	2 (1.8%)	2 (2.9%)	0	
Vocal Cord Palsy				*0.203*
From previous operation†	3 (2.7%)	3 (4.3%)	0	
None	62 (56.4%)	62 (88.6%)	39 (97.5%)	
Transient	5 (4.5%)	5 (7.1%)	0	
Permanent	2 (1.8%)	1 (1.4%)	1 (2.5%)	
Hypoparathyroidism				*0.745*
From previous operation†	6 (5.5%)	3 (4.3%)	3 (7.5%)	
None	96 (87.3%)	61 (87.1%)	35 (87.5%)	
Transient	6 (5.5%)	4 (5.7%)	2 (5.0%)	
Permanent	1 (0.9%)	1 (1.4%)	0	

†Pre-existing permanent vocal cord palsy or hypoparathyroidism before operation

Dicussion & Conclusion

Utility of tattooing in re-operations

- Recurred lesions measured less than 1 cm in size
- Some operations included a frozen section analysis, which prolonged operation time.
- More than half of the re-operations involved dissecting recurred lesions operative bed; there was an increased risk of damage to the recurrent laryngeal nerve (RLN) and the parathyroid glands.

Surgical completeness and oncologic outcomes

- Post-operative decrease in serum thyroglobulin (Tg) values indicated a reduction in tumor burden following surgery

Safety of reoperations utilizing tattoo localization

- Incidence of permanent vocal cord palsy comparable to initial thyroidectomy procedures, hypoparathyroidism kept minimal
- Bleeding occurred in two cases, which did not require additional surgery
- A single case of chyle leakage required re-operation
- No statistical differences were found between the charcoal group and the indigocarmine group with regards to surgical completeness and safety