

# Daycare and Inpatient Hemithyroidectomy: A Cost Minimisation and Safety Study - Hospital Kuala Lumpur Malaysia Experience

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## ABSTRACT

**INTRODUCTION:** The duration of daycare surgery (DS) is relatively shorter compared to other types of surgeries. The main objective here is to provide comfort to the patients and family members without compromising safety and quality of medical care for the patients. In addition, there are many proven advantages of DS such as shorter waiting time, earlier return to work, reduced cross-infections, reduced cancellation rates due to emergency cases and cost-effective. Due to the constraints of inpatient operating time and availability of hospital beds, thyroid surgery is performed as DS in our centre. In this study, we analysed the cost-effectiveness and safety between the daycare and inpatient hemithyroidectomy. **MATERIALS AND METHODS:** This cost minimisation comparative study was conducted in Kuala Lumpur Hospital, Malaysia, from January 2019 to June 2021. The total cost for each hemithyroidectomy for providers and patients were calculated for both groups. Any complications in the surgery for the two groups were documented. **RESULT:** Seventy-one patients were recruited: forty-one (57.7%) daycare hemithyroidectomies and thirty (42.3%) inpatient hemithyroidectomies. The cost of daycare hemithyroidectomy were significantly lower than the inpatient hemithyroidectomy with a median percentile of RM1089.00 (IQR= RM 339.48) and RM 1477.10 (IQR = RM 434.02) respectively (p-value <0.001). None of the patients in either group developed any surgical complications. **CONCLUSION:** Daycare hemithyroidectomy minimises the cost for providers while still maintaining the safety of the procedure. Therefore, daycare hemithyroidectomy is cost-effective and should be advocated in all tertiary hospitals in Malaysia.

### Keywords

cost-minimization analysis, daycare hemithyroidectomy, inpatient hemithyroidectomy, safety

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## INTRODUCTION

Daycare surgery (DS) or outpatient surgery is defined as a procedure during which patients undergo elective operations on the days of their admission, and then are discharged within 24 hours after surgery.<sup>1</sup> This mode of surgery has several advantages, including an earlier return to work for patients, early mobilisation, reduced risk of cross-infection, minimal disruption of the personal life of patients and reduced cancellation rates due to emergency cases appearing.<sup>2</sup> The thyroid gland, located at the anterior part of the neck, is easily accessible and is not too close to vital structures. Thus, simple thyroid surgery

should not have significant life-threatening complications. Furthermore, physiologically, removing half of the thyroid gland would not cause any debilitating hormonal insufficiency. In order to attempt to reduce costs, the above advantages have prompted interest in surgeons performing hemithyroidectomy as a daycare surgical procedure. DS is safe, has low recurrent laryngeal nerve injury, and a potentially overall cost reduction compared to elective inpatient hemithyroidectomy. There is no doubt that by performing hemithyroidectomy surgery as daycare will result in cost saving as less cost is incurred for hospital

stay; however the exact value and cost reduction in the Malaysian setting is not known. By knowing this, we will be able to know the amount of cost saved that can be then be directed to the other needs in hospitals.

“The American Thyroid Statement on Outpatient Thyroidectomy” has provided the eligibility criteria for this type of surgery. It has recommended that for a daycare thyroidectomy to be safely performed, a patient must be carefully selected, and precautionary measures should be undertaken to maximise communication and minimise complications.<sup>3</sup> Furthermore, studies have compared the safety of hemithyroidectomy to total thyroidectomy with regard to recurrent laryngeal nerve injury or cervical neck hematoma.<sup>4,5,6</sup> Hence, daycare hemithyroidectomy is an exciting and convenient alternative to conventional elective inpatient hemithyroidectomy.

In Malaysia, the concept of daycare thyroid surgery is relatively new. Based on the Malaysia protocol for daycare anaesthesia, there were 27 suitable general surgery procedures listed for day care surgery; however, hemithyroidectomy was not one of them.<sup>18</sup> There was no Malaysian data available on the percentage of cost saving daycare hemithyroidectomy can provide to the hospital. Kuala Lumpur Hospital (HKL), which is a major endocrine surgery centre with a high number of thyroid cases, has been performing daycare thyroid surgery since October 2017. Therefore, this study was aimed to compare the costs involved in daycare hemithyroidectomy and elective inpatient hemithyroidectomy from the perspectives of HKL and the patients. We also wanted to assess the safety of daycare hemithyroidectomy by comparing the complications rate between daycare surgery and inpatient elective surgery.

## **METHODOLOGY**

This is a cross-sectional study of daycare hemithyroidectomy and inpatient hemithyroidectomy was conducted in HKL from January 2019 to June 2021. The study was approved by the Board of Ethical Committee Members of Universiti Kebangsaan Malaysia (FF-2020-335) and the Malaysian Ministry of Health Medical Research and Ethics Committee (MREC) (NMRR-20-

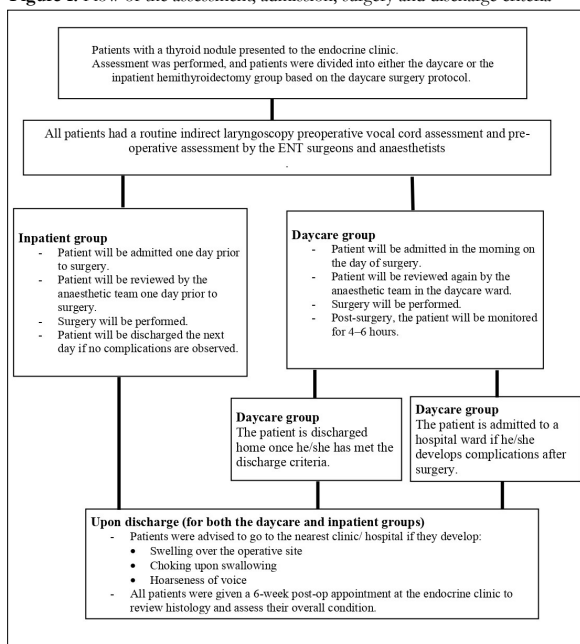
1579-53862). Purposive sampling method was used to recruit patients. Patients with thyroid nodule who presented to Breast and Endocrine clinic who eligible into our inclusion criteria were assigned into two groups: a daycare hemithyroidectomy group and an inpatient elective hemithyroidectomy group. The patients in both groups underwent hemithyroidectomy as the type of thyroid surgery. The initial intended study design was a prospective study. However, due to COVID 19 pandemic, there was difficulty to achieve the calculated sample size, especially for inpatient group. Thus cross sectional study design was used and retrospective data from Jan 2019 till June 2020. Seventy percent of the daycare group and 40% of inpatient group were from prospective data.

The inclusion criteria were as follows: age more than 18 years old, those who underwent hemithyroidectomy for either solitary thyroid nodule or multinodular goitre with a dominant nodule in one lobe, a maximum thyroid nodule size of 4 cm, American Society of Anaesthesiologists (ASA) 1 or ASA 2 classification, and agreed to participate in this study. Patients who were on anticoagulant or antiplatelet medications, a previous history of thyroid surgery or with retrosternal goitre, toxic nodular goitre or thyroid cancer were excluded.

Patients were then assigned to the daycare hemithyroidectomy group and the inpatient hemithyroidectomy group (Figure 1) based on the daycare surgery protocol criteria: age < 65 years, distance of less than 22 km to HKL and not on any anticoagulation medications. Patients who did not meet the criteria for daycare surgery which include distance more than 22 km to HKL, no care taker to take care of them postoperatively at home, and patients who requested to do surgery as inpatient due to personal reasons were placed in the inpatient hemithyroidectomy group. All patients had a routine indirect laryngoscopy preoperative vocal cord assessment and pre-operative assessment by Ear, Nose and Throat (ENT) surgeons and anaesthetists. All of the surgeries were performed by either a consultant endocrine surgeon or a fellow endocrine surgeon. Following the surgery, regular vital signs monitoring, and any post-operative complications were recorded. Daycare patients who had no immediate post-operative complications,

adequate pain control, normal vital signs and able to take orally were discharged on the same day. Those who had inpatient surgery were discharged the following day. Six-week outpatient appointment was given to review the histopathological reports and to assess any late complications. Figure 1 shows the flow of pre-operative assessment, admission and discharge criteria.

**Figure 1:** Flow of the assessment, admission, surgery and discharge criteria



## Cost Calculation

The cost for the two types of surgery was calculated using a formula based on the guidelines for a cost analysis in primary healthcare by Creese et al. and Drummond et al.<sup>7,8</sup> As recommended by the Malaysian guidelines, capital costs will be adjusted to the 2015 values at a discount rate of 5% per annum in the base case analysis (Malaysia Pharmaceutical Services Division 2012).<sup>18</sup> All costs in the analysis were presented in Ringgit Malaysia (RM). This study analysed the costs of hemithyroidectomy for the providers, patients, and total costs which is a sum of provider and patient costs. The total costs per patient were calculated, as shown in figure 2 below:

$$\text{Total costs for a hemithyroidectomy per patient} = \text{Capital cost} + \text{Recurrent cost (provider)} + \text{recurrent cost (patient)}$$

$$\text{Cost for a hemithyroidectomy (provider)} = \text{Capital cost} + \text{Recurrent cost (provider)}$$

$$\text{Cost for a hemithyroidectomy (patient)} = \text{Recurrent cost (patient; based on the patient's cost to travel to hospital for the surgery)}$$

**Figure 2:** Cost calculation

The definition of each cost calculation is as shown in figure 3 below:

Cost calculated	Cost definition
Capital cost (provider)	Building cost (cost of operation theatre area per metre square) + equipment cost used in hemithyroidectomy procedure (energy device used, thyroidectomy set)
Recurrent cost (provider)	Maintenance + utilities + consumable used in hemithyroidectomies (gauze, sutures, liga clip) + staff salary + medication cost (medication used intraoperatively anaesthetist and medication upon discharge)
Recurrent cost (patient)	Cost to travel to hospital for surgery (based on mileage)

**Figure 3:** Definition of each cost calculated.

## Statistical Analysis

Data analysis was performed using Statistical Package for Social Science (SPSS) version 26. The continuous data were reported as median and interquartile range (IQR), and the categorical variables were reported as frequency and percentage. The Mann-Whitney U test was used to compare the significance of the cost of hemithyroidectomy between the daycare and inpatient groups. The chi-square test was used to analyse the complication rate between the two groups.

## RESULTS

Seventy-one patients were recruited: forty-one (57.7%) daycare hemithyroidectomies and thirty (42.3%) inpatient hemithyroidectomies (Table 1). Majority of patients were females; 23 females (76.7%) in the inpatient group and 32 females (78.0%) in the daycare group. Compared to the inpatient group, the daycare patients were younger with a median age of 36 years old. However, there were no statically significant differences in the age, gender, ASA classification of patients, and duration of the surgery, between the two groups except the duration of hospital stays and distance from HKL. Due to the duration of stay and distance to HKL, significant difference between these 2 groups was expected as patients were done as in patient will stay longer in hospital compared to daycare who was discharged same day. Therefore, the cost incurred by patients will be omitted from this study. For the daycare group, the median of hospital stay was 8 hours compared to 52 hours for the inpatient group. The clinical characteristics and sociodemographic data of patients is shown in Table 1.

**Table 1:** Demographic Characteristics of the Patients

		Inpatient	Daycare	p-value
<b>Gender</b>	Female	23 (76.7%)	32 (78.0%)	1.000
	Male	7 (23.3%)	9 (22.0%)	
	Total	30 (100%)	41 (100%)	
<b>Age (median) (years)</b>		44.5 (IQR=20)	36 (IQR=18)	0.066
<b>Race</b>	Malay	16 (53.3%)	25 (61.0%)	0.959
	Chinese	9 (30.0%)	10 (24.4%)	
	Indian	5 (16.7%)	2 (4.9%)	
	Others	0 (0.0%)	4(9.7%)	
<b>ASA Score</b>	1	13 (43.3%)	27 (65.9%)	0.343
	2	17 (56.7%)	14 (34.1%)	
<b>Pre-operative vocal cord assessment</b>	Normal	30 (100.0%)	41 (100.0%)	
	Abnormal	0	0	
<b>Distance from Hospital (median) (km)</b>		19(51.85)	10 (IQR=5.85)	0.006
<b>Duration of hospital stay (median) (hours)</b>		52 (IQR=0)	8 (IQR=2)	<0.001
<b>Duration of surgery (median) (min)</b>		65 (IQR=36)	60 (IQR=33)	0.787

The most common indication for hemithyroidectomy surgery was solitary thyroid nodule, whereby 37 (90.3%) cases were done as daycare surgery and 27 (90%) cases as inpatient surgery. The preoperative fine needle aspiration cytology (FNAC) results based on the Bethesda scoring of the thyroid nodule is shown in Table 2. Only 8 (19.5%) cases in the daycare group and 7 (23.3%) cases in the inpatient group did not undergo preoperative thyroid nodule biopsy. This was because the benign features of the ultrasound showed a cystic and spongiform appearance.

Postoperatively, the patients were given a 6-week appointment to review their final histopathological examination (HPE) results. Table 2 shows the postoperative HPE results for the patients. One patient (2.4%) in the daycare group had papillary carcinoma, and 7(23.3%) patients in the inpatient group had malignant results, 3 (10%) of which were microcarcinoma.

As for cost analysis, the provider's cost for hemithyroidectomy was statistically significantly lower in the daycare group with a median value of RM 1089.00 compared to the inpatient group with a median value of RM 1477.10 ( $p < 0.001$ ) (Table 3). Using the cases in the

**Table 2:** Bethesda Classification of Thyroid Nodule Fine Needle Aspirations Prior To Surgery and Final Histopathological report after surgery

Bethesda Score	Inpatient	Daycare
<b>0</b>	7 (23.3%)	8 (19.5%)
<b>1</b>	5 (16.7%)	4 (9.8%)
<b>2</b>	11 (36.7%)	26 (63.4%)
<b>3</b>	1 (3.3%)	2 (4.9%)
<b>4</b>	4 (13.3%)	0 (0.0%)
<b>5</b>	2 (6.7%)	1 (2.4%)
<b>6</b>	0 (0%)	0 (0%)
<b>Histopathological Report</b>	Inpatient	Daycare
<b>Benign</b>		
Nodular hyperplasia	19 (63.3%)	27 (65.9%)
Haemorrhagic/benign cyst	3 (10.0%)	6 (14.6%)
Follicular adenoma	0 (0.0%)	5 (12.2%)
Chronic lymphocytic thyroiditis	0 (0.0%)	1 (2.4%)
Hurtle cell adenoma	1 (3.3%)	1 (2.4%)
Follicular adenoma with minimally invasive follicular thyroid carcinoma	1 (3.3%)	0 (0.0%)
Nodular hyperplasia with papillary microcarcinoma	2 (6.7%)	0 (0.0%)
<b>Malignant</b>		
Follicular variant of papillary thyroid carcinoma	1 (3.3%)	0 (0.0%)
Classic papillary thyroid carcinoma	3 (10.0%)	1 (2.4%)

year 2020 as a reference point, the total annual cost to the provider was calculated. In that year, 60 hemithyroidectomies were performed; 29 daycare and 31 inpatient cases, giving a ratio of 50:50. Therefore, the total cost of performing 60 hemithyroidectomies was RM 77,371.00 which comprising RM 31,581.00 of daycare and RM 45,790.10 of inpatient costs. However, if the number of daycare hemithyroidectomy cases had increased to 80% with the total cost would have been RM 69,997.00. This would have resulted in a reduction of total cost by RM 7,373.90 per annum. In other words, the more daycare hemithyroidectomies were performed in a year, the lesser the financial burden for the hospital provided the cost per patient in each hemithyroidectomy group remains the same throughout the year. This is the projection of estimated cost saving if the percentage of daycare surgery were to increased to 80%.

**Table 3:** Comparison of the provider's for the daycare and inpatient hemithyroidectomy.

	Group	n	Median (RM) (IQR)	p-value
<b>Provider's cost</b>	Daycare	41	1089.00 (339.48)	< 0.001
	Inpatient	30	1477.10 (434.02)	

During the follow-up clinic appointments, hoarseness of voice or other complications were not observed in the patients. Only 1 (2.4%) patient in the daycare group had inadvertent removal of the parathyroid gland; however, the results were not statistically significant. This patient did not develop any symptoms of hypocalcaemia, and it was noted when reviewing her HPE results.

**Table 4:** Estimation of cost-savings following hemithyroidectomy by the provider (hospital) with a ratio of 50:50 and of 80:20 in the year 2020.

	Location	Mean cost per patient (RM)	Number of hemithyroidectomies performed	Total cost (RM)
Cost with a ratio of 50:50	Daycare	1089.00	29	31,581.00
	Inpatient	1477.10	31	45,790.00
<b>Actual total cost</b>				<b>77,371.00</b>
Estimated cost with a ratio of 0:100	Daycare	1089.00	0	0
	Inpatient	1477.10	60	88,626.00
<b>Estimated total cost</b>				<b>88,626.00</b>
Estimated cost with a ratio of 80:20	Daycare	1089.00	48	52,272.00
	Inpatient	1477.10	12	17,725.00
<b>Estimated total cost</b>				<b>69,997.00</b>
<b>Cost-saving if daycare hemithyroidectomies are increased from 50:50 to 80:20 ratio</b>				<b>77,371.00 - 69,997.00 = 7,374.00</b>

## DISCUSSION

This study analysed the outcomes of daycare hemithyroidectomy, focusing on the cost-saving aspect and safety of the surgery compared to conventional inpatient hemithyroidectomy. Based on the literature, the definition of daycare surgery or outpatient surgery varies widely from performing surgery in a daycare centre and discharging the patient the evening of the same day to performing surgery and discharging a patient within 23 hours after admission.<sup>9,10,11</sup> Hence, interpreting of data reported in other studies must be done with caution. In government hospitals in Malaysia, daycare surgery means performing surgery and discharging the patient on the same day, as long as the discharge criteria are fulfilled.

The results of the present study clearly shows that the cost for daycare hemithyroidectomy was lower for the provider (HKL) than the cost for patients by inpatient

hemithyroidectomy. Several studies reported a similar findings: for daycare hemithyroidectomy, the overall reduction in the cost of surgery ranged from 22% to 30%.<sup>12-14</sup> In the United States of America, the cost for performing the surgery and the time in the post-op recovery room saved around \$2500 per ambulatory case.<sup>10,15</sup> In our study, the cost for hemithyroidectomy for the provider was RM 1089.00 (IQR=339.48) for daycare hemithyroidectomy and RM 1477.10 (IQR=434.02) for inpatient hemithyroidectomy ( $p < 0.001$ ). Thus, daycare hemithyroidectomy has a cost-savings of RM 388.10 per patient. However, the cost patients cannot be compared for these two groups as there was significant differences of distance of patients traveling to HKL.

According to the American Thyroid Association (ATA), outpatient thyroid surgery helps to reduce the utilisation of hospital resources that can be syphoned to other important needs in the facility. In this study we calculated the annual cost saving of daycare hemithyroidectomy to the hospital by using year 2020 as the reference point (Table 4). There were no previous data on the optimal percentage of hemithyroidectomy cases that could be performed as daycare. Thus, we were estimating that a maximum of 80% cases can be done as daycare to project the cost saving if number of daycare cases were increased. In that year 2020, 60 hemithyroidectomies were done, of which 29 were in daycare, and 31 were inpatient. We calculated the estimated total cost if all cases were done as inpatient; the actual total cost whereby the proportion of daycare was around 50%; and the estimated total cost if the proportion of daycare cases were increased to 80%. The figures obtained were RM88,626.00, RM 77,371.00 and RM69,997.00, respectively (Table 4). The actual cost reduction was 13% when 50% of the surgeries (29 cases) were done on as daycare surgery. This result was lower than that reported by Mowchensan et al., which was 30% due to the subsidisation by the government.<sup>14</sup> However, if the proportion of daycare hemithyroidectomies were increased from 50% to 80%, the cost-saving would further be increased by 9.5%, which is an estimated savings of RM 7373.00 for the hospital.

These figures prove that daycare hemithyroidectomy can reduce the overall cost for providers. Furthermore, it is

more cost-effective if the number of daycare hemithyroidectomies increases. Therefore, these figures in our study can be used as a guide to encourage other government hospitals in Malaysia to perform daycare hemithyroidectomies instead of inpatient hemithyroidectomies. Daycare surgery will also be more beneficial for patients because it reduces the need for hospitalisation thus further decreasing expenditure. However, our study was unable to determine the actual cost savings for patients in 2020 because we were unable to obtain information about several factors, such as the cost of travelling to HKL or the individual cost of daily salary loss if the patients were on medical leave.

The discretion of the surgeon is vital for the selection of daycare hemithyroidectomy. There are several relative contraindications for this surgery: anticipated difficult surgical dissection, patients on anticoagulation medication or those with blood disorders, lack of adult support at home and patient anxiety about undergoing an outpatient procedure.<sup>16</sup> Patients who planned for daycare surgery should fulfil the daycare hemithyroidectomy criteria to prevent post-surgical complications.<sup>3</sup> The criteria includes an ASA 1 or ASA 2 classification, the patient is given adequate counselling and fully understands the protocol for the daycare surgery including care requirements after surgery, the patient lives near the hospital, and a skilled surgeon will perform the surgery. Once the surgery is completed, patients will be assessed by the surgeon before being discharged, and they must fulfil the discharge criteria prior to being sent home. The requirements for discharge include: the patient can tolerate liquids and medications, has adequate pain control, is able to void satisfactorily and ambulate, has no immediate complications, such as neck hematoma, dyspnoea, dysphonia or dysphagia, adequate social support, and has normal vital signs.

Our study maintained the safety of daycare hemithyroidectomy according to the guidelines. The surgeries were done by breast and endocrine surgeons with careful patient selection for those undergoing a planned daycare hemithyroidectomy. Patient selection depends on the characteristics and the disease characteristics of the patient's. Disease characteristics include the size of the thyroid nodule ( $\leq 4$  cm), the

presence of a benign thyroid nodule based on preoperative biopsy, no retrosternal extension and normal vocal cord assessment pre-surgery. The trained breast and endocrine surgeons use a standardised technique when performing the surgeries. Cervical haematoma is a crucial complication that needs to be avoided for daycare hemithyroidectomy. Studies on symptomatic cervical haematoma revealed that 40% to 50% present within 4 to 6 hours of surgery, 40% within 7 to 24 hours and 10% to 20% after 24 hours.<sup>6,18</sup>

There was not much difference in the length of surgery between in our two study groups: 66.39 (SD=21.51) minutes in the daycare group and 73.83 (SD=24.01) minutes in the inpatient group. No post-hemithyroidectomy complications were observed for the daycare group, similar to the inpatient group. This shows that, with careful selection of patients and surgery performed by trained breast and endocrine surgeon, the safety of daycare hemithyroidectomy were maintained. Only one patient had inadvertent removal of the parathyroid gland, which was recognised after reviewing her HPE result. Despite this, this patient did not develop symptoms of hypocalcaemia. The term, cost-effective, is defined as having a good value for the amount of money paid. In our study, no complications were seen in either group. This indicates that daycare surgery for hemithyroidectomy is also efficient and cost-effective.

In our study, one patient (2.4%) in the daycare group had papillary carcinoma, and 7 (23.3%) patients in the inpatient group had a malignant result; 3 (10%) of the patients in the inpatient group had microcarcinoma after reviewing the HPE results. It is possible to perform hemithyroidectomy for early thyroid carcinoma in a daycare setting. However, small thyroid cancer should be a good prognostic index and handled by an experienced surgeon to deal with any unexpected intra-operative difficulties.

This study had a few limitations. Due to the COVID-19 pandemic, the study design was change to cross sectional instead of prospective. Thus some of the data collected were from retrospective data which lead to the missing of some of the hidden costs for patients (the number of days the patient was absent from work, the number of days the

patient's caregiver was absent from work, the type of transport used by the patient to get to HKL and the route used, such as a highway with or without a toll). Other than that, due to the retrospective data, there was significant difference between distance travel to HKL making the comparison for patient cost is not appropriate in this study. We suggest in the future, a prospective study to be done to calculate the exact cost saving for daycare hemithyroidectomy and the distance of travel for both groups should be <22 km.

## CONCLUSION

Daycare hemithyroidectomy minimises the cost for providers while still maintaining the safety of the procedure. Therefore, with a very low rate of adverse outcomes, daycare hemithyroidectomy is cost-effective and should be advocated in hospitals in Malaysia.

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