

ORIGINAL ARTICLE

Suction catheter usage and cost at long-term care hospitals in Republic of Korea

Kyung Hun Nam^{1,2}, Dae Hyun Kim³, Won Ki Baek^{1,2}, Han Byul Lee^{1,2}, Joo Hyung Kim*^{1,2}

¹Department of medicine, Ajou University Intermediate Care Hospital, Suwon, Republic of Korea

²Medical Research Collaborating Center, Ajou University School of Medicine, Suwon, Republic of Korea

³Health Care Administration Program, College of Business, Idaho State University, Idaho, United States

Received: January 10, 2021

Accepted: February 17, 2021

Online Published: February 24, 2021

DOI: 10.5430/jha.v10n1p1

URL: <https://doi.org/10.5430/jha.v10n1p1>

ABSTRACT

A substantial number of Korean patients who require tracheostomy or oral suctioning are admitted to long-term care hospitals. However, under the Korea's current daily fixed-rate reimbursement system, the cost of suction catheters is a considerable financial burden. To further discuss proper reimbursement policies for suction catheters in South Korean long-term care system, we examined the number and cost of suction catheters used in a long-term care hospital. This study is a single-center prospective cohort observational study that was conducted on patients admitted to the step-down unit at Ajou University Intermediate Care Hospital. Data of 47 patients were collected for this study. The average amount of suction catheter use per person was 529 during the 62 days of the study period. Daily suction catheter usage showed a statistically significant difference between patients with and without tracheostomy (10.5 ± 6.9 vs 2.1 ± 3.3 , p -value $< .001$). It also showed a significant difference between patients who were diagnosed with or without pneumonia during hospitalization (12.3 ± 4.2 vs 5.5 ± 4.2 , p -value $< .001$). The estimated cost of suction catheter usage for 30 days on a single patient who has tracheostomy was about 160,000 Korean won (\$160), which was about 7.3% of the total monthly reimbursement. With the current reimbursement system, there is a potential risk of improper reuse and underuse of suction catheters. To improve respiratory care and prevent pneumonia, we suggest a separate reimbursement system for suction catheters for patients with tracheostomy in South Korean long-term care hospitals.

Key Words: Suction, Catheterization, Tracheostomy, Long-term care hospitals

1. INTRODUCTION

The long-term care hospital system in the Republic of Korea is unique, compared to other medical systems in Korea. It uses a daily rate reimbursement system, also known as the Resource Utilization Groups (RUG) reimbursement system, which is based on 5 categories according to the patients' activities of daily living (ADL) scores.^[1] Originally, this system was designed to deliver cost-effective management for sub-acute and long-term care patients.^[1] However, there had been differing views over the efficacy of this system and the

potential risk of deterioration of quality of medical care.^[2] A similar problem is being shown in the United States as well. National organizations such as the Centers for Medicare and Medicaid Services (CMS), Medicare Payment Advisory Commission (Med-PAC), and the Department of Health and Human Services (HHS) have collaborated to develop a new reimbursement model for Medicare Part A in skilled nursing facilities.^[3] Skilled nursing facilities are currently utilizing the Prospective Payment System (PPS), which is based on the RUG reimbursement system, and the agencies believed

*Correspondence: Joo Hyung Kim; Email: conan1602@nate.com; Address: Department of Medicine, Ajou University Intermediate Care Hospital, 21, World cup-ro 150 beon-gil, Yeongtong-gu, Suwon, Gyeonggi-do, 16500, Republic of Korea.

PPS is incorrectly incentivizing facilities for the usage of therapy services.^[4]

Suction catheter, one of the most commonly used medical devices in Korean long-term care hospitals, is among the top medical supplies that is affecting the financials of these hospitals due to the RUG reimbursement system. Suctioning plays an important role in preventing respiratory complications among patients with tracheostomy. However, under the current RUG reimbursement system, the cost of medical supplies has become a significant financial burden. Furthermore, there continue to be reports about inappropriate reusage or reduction of suctioning being prevalent in Korean long-term care hospitals.^[5] This is a serious problem since a substantial number of patients who require tracheostomy or oral suctioning are admitted to long-term care hospitals in Korea.

To date, no research has been conducted on suction catheter usage at Korean long-term care hospitals. Therefore, an observational study was conducted to estimate the number and cost of suction catheters used to further discuss proper reimbursement policies for suction catheters in the Korean long-term care system.

2. METHODS

2.1 Study design and recruitment

A prospective observational study was conducted on patients admitted to the step-down unit at a University-level intermediate care hospital from July 1st to August 31st of 2020. Patients' demographics, underlying medical conditions, reasons for admission, and initial hospitalization evaluation records were reviewed. To confirm the daily suction catheter usage, 100 suction catheters were allocated to each patient at 11AM each day during the study period, and the remaining suction catheters were checked for while 100 suction catheters were being allocated to patients at 11AM the next day. Institution Review Board of Ajou University Hospital approved this study and written informed consent was exempted for this study since this was an observational study. (IRB approval No: ICH-MDB-20-437)

2.2 Statistical analysis

Ratio (%) was used for categorical variables, and mean and standard deviation were used for continuous variables. Proportions were compared using the Fisher's exact test and continuous variables were compared using a *t*-test with unequal variance. The significance level was set at 0.05 for all analyses. All statistical analysis was performed using STATA version 16.1 software (StataCorp LLC., Texas, USA).

3. RESULTS

A total of 47 patients were enrolled in this study. The average age was 71 and cerebrovascular disease was the most common diagnosis for admission. According to the admission medical record, 76.6% had tracheotomy tubes, and 31.9% required oxygen therapy. 27.7% of patients had underlying lung disease, and 43.8% of patients were diagnosed with pneumonia at least once during hospitalization. The average number of suction catheters used per person was 529 during the 62-day study period, which equates to 8.5 catheters used per day (see Table 1).

Table 1. The basic characteristic of study subjects

Basic characteristics	N = 47 (SD)
Demographics	
Age	70.6 ± 13.9
Male (%)	26 (55.3)
Height (cm)	162.0 ± 9.9
Weight (kg)	55.5 ± 10.2
Comorbidities	
Cerebrovascular disease (%)	32 (68.1)
Hypertension (%)	24 (51.1)
Diabetes (%)	18 (38.3)
Hemiplegia (%)	18 (38.3)
Quadriplegia (%)	17 (36.2)
Adjunct treatments	
Tracheostomy care (%)	36 (76.6)
Oxygen therapy (%)	15 (31.9)
Nebulizer treatment (%)	4 (8.5)
Mechanical ventilation (%)	1 (2.1)
Pneumonia	
Before admission (%)	13 (27.7)
During admission (%)	21 (43.8)
Suction catheter usage	
Study period (62 days)	529.0 ± 445.7 (186, 468, 710)
Per Day	8.55 ± 7.2 (3, 7.5, 11)

Note. Plus-minus values are means ± standard deviation. Only the five most common comorbidities are listed. Three numbers inside the parenthesis below the mean and standard deviation are lower quartile, median, and upper quartile.

The usage of suction catheters was compared among patients with or without a tracheostomy, pneumonia during hospitalization, underlying lung disease, use of oxygen therapy, cerebrovascular disease, hemiplegia, and quadriplegia. The average daily suction catheter usage per single patient during the study period showed a statistically significant difference between patients with and without tracheostomy (10.5 ±

6.9 vs 2.1 ± 3.3, *p*-value < .001). Furthermore, statistically significant difference was shown in the average daily suction catheter usage per patient among patients who were or were not diagnosed with pneumonia during hospitalization (12.3 ± 4.2 vs 5.5 ± 4.2, *p*-value < .001) (see Table 2).

Table 2. Suction catheter usage compared with or without a tracheostomy, pneumonia during hospitalization, underlying lung disease, use of oxygen therapy, cerebrovascular disease, hemiplegia, and quadriplegia

	During the study period	Per day	<i>p</i> -value
Tracheostomy			
yes (n = 36)	651.4 ± 428.5 (346, 509, 856)	10.5 ± 6.9	< .001
no (n = 11)	128.4 ± 202.0 (8, 12, 186)	2.1 ± 3.3	
Pneumonia during admission			
yes (n = 21)	763.9 ± 260.3 (488, 710, 1160)	12.3 ± 4.2	< .001
no (n = 26)	339.3 ± 260.3 (38, 346, 480)	5.5 ± 4.2	
Underlying lung disease			
yes (n = 13)	646.9 ± 160.9 (336, 518, 710)	10.5 ± 9.3	.258
no (n = 34)	483.9 ± 383.3 (186, 460, 710)	7.8 ± 6.2	
Oxygen therapy on admission			
yes (n = 15)	381.5 ± 372.5 (14, 356, 488)	6.2 ± 6.0	.126
no (n = 32)	598.2 ± 465.4 (285, 509, 856)	9.6 ± 7.5	
Cerebrovascular disease			
yes (n = 32)	491.6 ± 435.4 (139, 474, 709)	7.9 ± 7.0	.396
no (n = 15)	608.8 ± 472.2 (266, 428, 1012)	9.9 ± 7.6	
Hemiplegia			
yes (n = 18)	477.9 ± 415.6 (136, 466, 708)	7.7 ± 6.7	.535
no (n = 29)	560.8 ± 467.7 (266, 468, 710)	9.1 ± 7.5	
Quadriplegia			
yes (n = 17)	522.0 ± 450.8 (228, 488, 624)	8.4 ± 7.3	.929
no (n = 30)	533.0 ± 450.5 (186, 440, 712)	8.6 ± 7.3	

Note. Plus-minus values are means ± standard deviation. Three numbers inside the parenthesis below the mean and standard deviation are lower quartile, median, and upper quartile. Reported *p*-value is derived from *t*-test with unequal variance for the daily usage of suction catheters.

The distribution of suction catheter usage in patients with or without tracheostomy is illustrated in Figure 1. It was observed that 81.1% of the patients without tracheostomy used 300 or fewer suction catheters during the study period, whereas 44.4% of the patients with tracheostomy used 600 or more suction catheters. The maximum number of suction

catheters used in a single tracheostomy patient was 1,708. A statistically, significant difference was shown in the number of suction catheters being used between patients with or without tracheostomy (see Table 3).

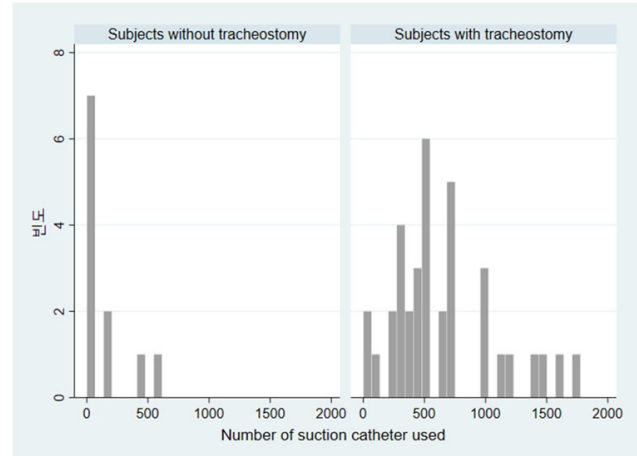


Figure 1. Distribution of total number of suction catheter used during the study period (62 days) compared in subjects with and without tracheostomy

As of August 2020, the market price of a single suction catheter in South Korea ranged anywhere from 400 to 600 Korean won, which equates to about 40 to 60 US cents.[6] For this study, the price of a single suction of catheter was calculated as 500 Korean won (50 cents). Using this, it was calculated that the monthly cost suction catheters for patients without tracheostomy is around 31,000 Korean won (\$31), while the cost for patients with tracheostomy is around 157,000 Korean won (\$157) (see Table 4).

4. DISCUSSION

The purpose of this study was to estimate the number and cost of suction catheters used to further discuss proper reimbursement policies for suction catheters in the Korean long-term care system. The result has shown that there was a significant difference in the number of suction catheter usage in patients with or without a tracheostomy or pneumonia. An average of 2.1 suction catheters per day were used on a patient without tracheostomy, while 10.5 were used per day on a patient with tracheostomy. An average of 5.5 suction catheters per day were used on a patient without a history of pneumonia but 12.3 suction catheters.

The Republic of Korea is one of the fastest aging countries in the world.[7] As a result, the medical cost for the elderly is growing rapidly as well. To prepare for the growing elderly population, the Korean government passed reimbursement legislation, which would limit unnecessary medical costs.

This reimbursement plan reimbursed long-term care hospitals in a fixed amount per day. For example, when a patient gets admitted to a long-term care hospital, that patient gets allocated into one of five categories, based on comorbidities

and ADL scores.^[1] The daily fixed rate, according to these five categories, is reimbursed monthly to the long-term care facilities.^[1]

Table 3. The distribution of suction catheter usage according to the presence or absence of a tracheostomy

Suction catheter usage	Without tracheostomy n = 11(%)	With tracheostomy n= 36 (%)	p-value
0-186	9 (81.8)	3 (8.3)	< .001
187-468	1 (9.1)	11 (30.6)	.244
469-710	1 (9.1)	11 (30.6)	.244
711-	0 (0)	11 (30.6)	.046

Note. Reported p-value is derived from Fisher’s exact test for the association between each category of suction catheter usage and presence of tracheostomy. The number of suction catheter usage was categorized by quartiles

Table 4. The estimated number of monthly suction catheter usage and its cost

Before outliers were omitted	Patient without tracheostomy	Patient with tracheostomy
Number of suction catheter used	62.1 ± 97.7	315.7 ± 207.0
Cost estimation (Korean Won*)	31,056 ± 48,865	157,864 ± 103,489
After outliers were omitted	Patient without tracheostomy	Patient with tracheostomy
Number of suction catheter used	62.1 ± 97.7	287.4 ± 174.8
Cost estimation (Korean Won*)	31,056 ± 48,865	143,725 ± 87,395

Note. Plus-minus values are means ± standard deviation. Two subjects with suction catheter usage more than 1,500 for the study period were omitted as an outlier. *1 dollar = 1,100 Korean Won

Unfortunately, recent studies have shown that the current reimbursement system is part of a cause for the deterioration of health care quality in Korea.^[2] More specifically, the reimbursement system, which includes the way long-term care hospitals get reimbursed for suction catheters seems to be problematic. The result of this study has shown that a daily average of 10.5 suction catheters were being used on a single patient with a tracheostomy, which results in the monthly cost of approximately 160,000 Korean won (\$160) per patient being used on suction catheters alone. With the daily fixed rate for a tracheostomy patient being 72,790 Korean won (\$73) as of December of 2020, suction catheters take up almost 7.3% of monthly reimbursements (160,000/(72,790 × 30)). Considering other medical devices and treatments that an individual patient needs to receive, it can be stated that the usage of suction catheter is becoming a considerable financial burden for Korean long term care hospitals under the current reimbursement system.^[5]

Due to this phenomenon, the number of long-term care hospitals in Korea are beginning to reuse suction catheters or save them for patients that absolutely require them.^[5] By reusing or not using suction catheters on patients, the quality of care that patients receive will ultimately get degraded. Hence, it

is believed that a separate reimbursement system for suction catheters should be required, for proper airway management can be delivered to patients with tracheostomy in Korean long-term care hospitals.

Limitation

There are several limitations to this study. Due to the design of the study, observational bias exists. Since there is no clear guideline for frequency of suctioning, individual variation during patient stay could influence the total number of suctioning. Furthermore, with individual hospitals and healthcare systems having their unique staffing and operational systems, the results of this study may not be generalizable to other long-term care hospitals in the Republic of Korea. Lastly, the period when this data was collected could potentially be a limitation since that time period was during when COVID-19 cases were still existing, which could have affected the demographics of the admitted patients.

5. CONCLUSIONS

Although airway management by suctioning is an important topic in long-term care hospitals, there has been no research on suction catheter usage at long-term care hospitals in Korea.

Under the current reimbursement system, suction catheters have become significant financial burden for Korean long-term care hospitals and the current study's results also support this. Due to this unfortunate circumstance, the quality of care that patients are receiving in Korean long-term care hospitals are deteriorating and it is believed one possible method to solve this phenomenon is to create a separate reimbursement system for suction catheters. By doing so, those hospitals will be less likely to reuse or save suction catheters

from patients due to financial problems.

FUNDING

Funding was provided from the Korea Institute for Healthcare Accreditation (<https://www.koiha.or.kr>; grantNo. 20200612-01).

CONFLICTS OF INTEREST DISCLOSURE

The authors declare they have no conflicts of interest.

REFERENCES

- [1] Lee JY, Jo MW, Yoo WS, et al. Evidence of a Broken Healthcare Delivery System in Korea: Unnecessary Hospital Outpatient Utilization Among Patients with a Single Chronic Disease Without Complications. *Journal of Korean Med Sci.* 2014; 29(12): 1590-1596. PMID: 25469056. <https://doi.org/10.3346/jkms.2014.29.12.1590>
- [2] Chun CB, Kim SY, Lee JY, et al. Republic of Korea: Health System Review. *Health Systems in Transition.* 2009; 11: 1-184.
- [3] Bowblis JR, Brunt CS. Medicare Skilled Nursing Facility Reimbursement and Upcoding. *Health Econ.* 2014; 23: 821-840. PMID: 23775721. <https://doi.org/10.1002/hec.2959>
- [4] Turcotte LA, Poss J, Fries B, et al. An Overview of International Staff Time Measurement Validation Studies of the RUG-III Case-Mix System. *Health Services Insight.* 2019; 12: 1178632919827926. PMID: 30828247. <https://doi.org/10.1177/1178632919827926>
- [5] Kim H, Jung YI, Kwon S. Delivery of Institutional Long-Term Care Under Two Social Insurances: Lessons from the Korean Experience. *Health Policy.* 2015; 119: 1330-1337. PMID: 26305121. <https://doi.org/10.1016/j.healthpol.2015.07.009>
- [6] Ku E, Lee G, Jeon M, Choi J, et al. Microbial Contamination of Reusable Suction Catheter and Cost Analysis of Reusable Suction Container and Disposable Suction Container. *Journal of Korean Biological Nursing Science.* 2019; 21(2): 133-140. <https://doi.org/10.7586/jkbns.2019.21.2.133>
- [7] Jeon B, Kwon S. Health and Long-Term Care Systems for Older People in the Republic of Korea: Policy Challenges and Lessons. *Health Systems and Reform.* 2017; 3(3): 214-223. PMID: 31514668. <https://doi.org/10.1080/23288604.2017.1345052>