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The Effect of Standardized Order Set for Intravenous Calcium Treatment on the Length of Hospital Stay in Secondary Hyperparathyroidism following Parathyroidectomy. Retrospective Pre-Post Study

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Abstract

Objective: The objective of this study is to assess if administering a post-operative standardized order set for intravenous calcium treatment for dialysis patients with secondary hyperparathyroidism who have undergone a parathyroidectomy will reduce the length of the hospital stay.

Methods: The medical records of dialysis patients who underwent subtotal PTX for symptomatic secondary hyperparathyroidism were reviewed prior to and after the introduction of a standard postoperative order set. The genders, duration of hospital stay as well as readmission rates of all patients were analyzed.

Results: The study population included 50 patients, with a mean age of 49 years. 25 patients were administered the standardized order set of intravenous calcium treatment following a subtotal parathyroidectomy. There was no statistical difference (p=0.7063) between the length of hospital stay in the group of the patients that received the post- operative standardized order set of intravenous calcium and the group that did not. Only 1 patient was readmitted during the study period.

Conclusion: There was no statistical difference in the length of hospital stay between the dialysis patients with secondary hyperparathyroidism who received the standardized order set of intravenous calcium and the patients who did not following a PTX.

Keywords: Secondary hyperparathyroidism; Parathyroidectomy; Intravenous calcium; Length of hospital stay

Abbreviations: SHPT: Secondary Hyperparathyroidism; PTH: Parathyroid Hormone Levels; KDOQI: Kidney Disease Outcomes Quality Initiative; PTX: Parathyroidectomy; Alkp: Alkaline Phosphatase

Introduction

Secondary hyperparathyroidism (SHPT) commonly develops in patients with chronic kidney disease [1-17]. SHPT is characterized by parathyroid hyperplasia and overproduction of the parathyroid hormone, resulting in hypercalcaemia and hyperphosphatemia [4,6-8,11,15-17]. As a result of the calcium and phosphate imbalance, SHPT is commonly associated with other co morbidities, including skeletal and cardiovascular diseases, leading to increased mortality [2,4,7,8,10,16,18].

The majority of patients with hyperparathyroidism are medically managed by phosphate binders, vitamin D analogues and/or calcimimetics in order to reduce the phosphate and parathyroid hormone (PTH) serum levels. However, according to the Kidney disease Outcomes Quality Initiative (KDOQI) guidelines, in cases refractory to medical treatment, parathyroidectomy (PTX) is recommended [1-7,11-17,19]. Three surgical parathyroidectomy approaches have been developed: subtotal parathyroidectomy, total parathyroidectomy with parathyroid autotransplantation, and total parathyroidectomy without auto grafting [11,12]. Subtotal PTX or total PTX with autotransplantation are the preferred approaches [3,5,11,12].

Post-operative hypocalcaemia, a result of reduced PTH serum levels, is a complication that is frequently encountered following PTX [15,18]. Rapid, severe and prolonged hypocalcaemia, known as hungry bone syndrome, commonly develops in patients with SHPT and severe bone disease [1,2,7,19-21]. The duration of hospital stay is typically prolonged these patients [1,5]. To alleviate this complication, intravenous calcium is given following the PTX [1-3,6,15,20]. The purpose of this study is to assess if administering a post-operative standardized order set of intravenous calcium treatment for dialysis patients with secondary hyperparathyroidism who have undergone a PTX will reduce the length of the hospital stay.

Methods

Patients

In this retrospective pre-post study, 50 patients' charts with chronic kidney disease that underwent subtotal PTX by a single general surgeon in Saskatoon, SK between April 2010 and May 2015 for symptomatic secondary hyperparathyroidism were reviewed. Patients with primary and tertiary hyperparathyroidism were excluded from the study. Research Ethics Board approval was obtained for this study. The information abstracted in this study included, gender and age of the patients, the number of patients who received standardized orders of intravenous calcium, length of hospital stay and readmission rates. The length of hospital stay was defined as the number of days in the hospital from the date of surgery to the date of discharge.

The patients were divided into two study groups: one that received post-operative standardized order set for intravenous calcium treatment

(Table 1), and one that did not. Patients' gender, age, and length of hospital stay between the two groups were compared.

Statistical analysis

We checked all variables regarding assumptions underlying the use of parametric and nonparametric statistics, and analyzed them accordingly. We performed Student's *t*- test, for the normally distributed variable (age), and Wilcoxon test for the non-normally distributed variable (length of stay). Chi-square test was used to examine the association between categorical variables. Data were analyzed using SAS software (v 9.4; SAS Cary, NC, USA). The level of significance was set at 0.05 (two-tailed).

Results

The study population included 18 females (36%) and 32 males (64%), with a mean age of 49 years, a median of 51.5 years, and a range of 20-75 years. The mean length of hospital stay was 5.3 days with a median of 4.0 days. Of the study population, only 1 (2%) patient was readmitted. 25 patients (50%) were treated with a standardized order set of intravenous calcium post-operatively. The patients' gender, age, length of stay and readmission rates and whether or not they received a standardized order set are outlined in Table 2.

Our study revealed no statistical difference (p>0.05) in the length of hospital stay (p=0.7063) between the group of patients that received the post-operative standardized order set of intravenous calcium (mean of 4.88 days) and the group that did not (mean of 5.72 days) (Table 3).

There were no significant differences in regards to age (p=0.1897) and sex (p=0.5557) when comparing the group of patients that received the standardized order set of intravenous calcium post-operatively and the group that did not. Outlined in Table 3.

Parathyroidectomy Post-op Order Set for Secondary Hyperparathyroidism	
Ionized Calcium (mmol/L)	**IV Calcium Gluconate Dose**
Less than 0.8	3 g and notify surgical resident
0.8–1.09	3 g
1.10–1.20	2 g
1.21–1.35	1 g
Greater than 1.35	None

Table 1: Post-operative standardized order sets for intravenous calcium treatment following a parathyroidectomy-One study group, comprised of 25 patients with secondary hyperparathyroidism, received standardized order set of intravenous calcium following a parathyroidectomy to determine if intravenous calcium treatment will decrease hospital stay.

Demographics and clinical characteristics of the study population		
Parameters		
Male/female, %	64/36	
Age, years	49.04±13.7	
Length of hospital stay	5.30±4.38	
Readmission	Yes	98%
	No	2%
Standardized Order Set	Given	50%
	Not Given	50%

Table 2: Demographics and clinical characteristics of the study population-The patients' sex, age, length of stay and readmission rates and whether or not they received a standardized order set are outlined in the table.

Standardized Order Set			p-value
	Given	Not Given	
Parameter			
Male/female, %	53.13/44.44	46.88/55.56	0.5557
Age	46.48±11.45	51.60±15.46	0.1897
Length of hospital stay	5.72±5.56	4.88±2.82	0.7063

Table 3: Comparison of the parameters in patients who were administered the post- operative standardized order set of intravenous calcium and the group that did not.

Discussion

In dialysis patients, secondary hyperparathyroidism is a common complication requiring surgical PTX if refractory to medical treatment. PTX drastically improves SHPT [14]. PTX has been shown to improve bone mineral density and reduce the incidence of fractures by 30% in patients receiving dialysis for chronic kidney disease [2,20]. Moreover, PTX is cost-effective, increases survival rates and improves quality of life [14]. In this study, all the patients received a subtotal PTX.

Despite of the benefits of the surgical procedure, postoperative hypocalcaemia is a common and serious complication. It results from calcium metabolism imbalance due increased absorption of calcium from the circulation into the bones, and cessation of osteoclastic activity and continued osteoblastic activity [1,7,18-21]. Postoperative hypocalcaemia is seldom symptomatic unless serum calcium levels fall below 2 mmol/L [18]. When it becomes symptomatic, hypocalcaemia can present as seizures, neuromuscular symptoms, such as numbness, tingling and muscle cramps, and may predispose to ventricular arrhythmias and sudden cardiac death. Postoperative hypocalcaemia and the associated clinical manifestations can be prevented through strict monitoring of the calcium serum levels, and administration of prophylactic intravenous calcium infusion and vitamin D analogues [1,3,18,19,21].

There is inconsistency regarding the management of postoperative hypocalcaemia. Cozzolino et al. has proposed initiating calcium infusion when a rapid decline in serum calcium is noted. Tominaga et al. suggested intravenous calcium treatment when Alkaline phosphatase (AlkP) levels are >500 IU/L. Cheng et al. recommended a preventive approach to start calcium infusion immediately following surgery in any patients who have a preoperative AlkP level of >200 IU/L. The KDOQI guidelines suggest that calcium infusion should begin when the blood levels of corrected total calcium fall below 7.2 mg/dl. However, administrating intravenous calcium immediately postoperatively may prevent hypocalcaemia altogether [1].

Hypocalcaemia following PTX can prolong the length of hospital stay. A prolonged length of stay can increase the risk of morbidity and mortality, and lead to increased financial burden on the healthcare system [2]. Recent studies have concluded that the mean length of hospital stay following a PTX for secondary hyperparathyroidism is 3.0 to 9.2 days, which is similar to our mean stay of 5.3 days [1]. This study investigated if administrating a standardized order of intravenous calcium following a PTX would reduce the length of hospital stay. Our data showed that there was no statistical significance between the group of patients that received the post-operative standardized order set of intravenous calcium and the group of patients that did not, even when variables including age and gender were accounted for. This could have been largely due to limitations of the study, including a small sample size and a non- randomized study design. Further studies are warranted to assess postoperative

hypocalcaemia in the setting of PTX, including studying a larger sample size, utilizing various order sets, and taking into account patients' co-morbidities.

Other studies have formulated various guidelines for treatment and prevention of postoperative hypocalcaemia following a PTX [1,18,19,21]. However, analysis of the effects of a standardized order set of intravenous calcium immediately following parathyroidectomy in dialysis patients with secondary hyperparathyroidism has not been previously done. Thus, we wanted to look at a standardized order set that would reduce the patient's length of hospital stay. Although our study did not find a significant difference between the group of patients who received the standardized order set and the group that did not, we have elucidated areas and topics for further research.

Conclusions

The management of postoperative hypocalcaemia following a parathyroidectomy in dialysis patients remains poorly defined [3,19]. Our study did not reveal that dialysis patients with secondary hyperparathyroidism receiving a postoperative standardized order set of intravenous calcium following a parathyroidectomy would have a shortened the hospital stay. This could be due to the inadequate sample size and other metrics that were not analyzed, such as number of inpatient episodes of significant hypocalcaemia, nursing time, patient co morbidities, and perioperative and other postoperative complications.

Conflict of Interest

No conflict of interest.

References

1. Cheng SP, Liu CL, Chen HH, Lee JJ, Liu TP, et al. (2009) Prolonged hospital stay after parathyroidectomy for secondary hyperparathyroidism. World J Surg 33: 72-79.
2. Viaene L, Evenepoel P, Bammens B, Claes K, Kuypers D, et al. (2008) Calcium requirements after parathyroidectomy in patients with refractory secondary hyperparathyroidism. Nephron Clin Pract 110: c80-c85.
3. Hamouda M, Dhia NB, Aloui S, El Mhamedi S, Skhiri H, et al. (2013) Predictors of early post-operative hypocalcemia after parathyroidectomy for secondary hyperparathyroidism. Saudi J Kidney Dis Transpl 24: 1165-1169.
4. Rashed A, Fahmi M, ElSayed M, Aboud O, Asim M (2004) Effectiveness of surgical parathyroidectomy for secondary hyperparathyroidism in renal dialysis patients in Qatar. Transplant Proc 36: 1815-1817.
5. Kurz P, Ewald U, Tsobanelis T, Roth P, Werner E, et al. (2009) Altered pattern of calcium kinetics in hemodialysis patients after parathyroidectomy. ASAIO Trans 36: M452-M456.
6. Dumasius V, Angelos P (2010) Parathyroid surgery in renal failure patients. Otolaryngol Clin North Am 43: 433-440.
7. Saliba W, El-Haddad B (2009) Secondary hyperparathyroidism: Pathophysiology and treatment. J Am Board Fam Med 22: 574-581.
8. Tomasello S (2008) Secondary hyperparathyroidism and chronic kidney disease. Diabetes Spectrum 21: 19-25.
9. Nikodimopoulou M, Liakos S (2011) Secondary hyperparathyroidism and target organs in chronic kidney disease. Hippokratia 15: 33-38.
10. Llach F (1999) Hyperphosphatemia in end-stage renal disease patients: pathophysiological consequences. Kidney Int Suppl 56: S31-S37.
11. de Francisco AL, Fresnedo GF, Rodrigo E, Piñera C, Amado JA, et al. (2002) Parathyroidectomy in dialysis patients. Kidney Int Suppl 61: S161-S166.
12. Ljutic D, Cameron JS, Ogg CS, Turner C, Hicks JA, et al. (1994) Long-term follow-up after total parathyroidectomy without parathyroid reimplantation in chronic renal failure. QJM 87: 685-692.
13. Albertucci M, Zielinski CM, Rothberg M, Sterpetti A, Klingman R, et al. (1988) Surgical treatment of the parathyroid gland in patients with end-stage renal disease. Surg Gynecol Obstet 167: 49-52.
14. Tominaga Y, Matsuoka S, Uno N, Sato T (2008) Parathyroidectomy for secondary hyperparathyroidism in the era of calcimimetics. Ther Apher and Dial 12: S21-S26.
15. Koonsman M, Hughes K, Dickerman R, Brinker K, Dunn E (1994) Parathyroidectomy in chronic renal failure. Am J Surg 168: 631-635.
16. Joy MS, Karagiannis PC, Peyerl FW (2007) Outcomes of secondary hyperparathyroidism in chronic kidney disease and the direct costs of treatment. J Manag Care Pharm 13: 397-411.
17. Cannata-Andia JB, Carrera F (2007) The pathophysiology of secondary hyperparathyroidism and the consequences of uncontrolled mineral metabolism in chronic kidney disease: the role of COSMOS. NDT Plus 1: i2-i6.
18. Loke SC, Kanesvaran R, Yahya R, Fisal L, Wong TW, et al. (2009) Efficacy of an intravenous calcium gluconate infusion in controlling serum calcium after parathyroidectomy for secondary hyperparathyroidism. Ann Acad Med Singapore 38: 1074-1080.
19. Cozzolino M, Gallieni M, Corsi C, Bastagli A, Brancaccio D (2004) Management of calcium refilling post- parathyroidectomy in end-stage renal disease. J Nephrol 17: 3-8.
20. Goh BL, Yudisthra MG, Hisham AN (2010) Alkaline phosphatase predicts calcium requirements after total parathyroidectomy in patients receiving dialysis. Br J Surg 97: 185-188.
21. Niramitmahapanya S, Sunthornthepvarakul T, Deerochanawong C, Sarinnapakorn V, Athipan P (2011) Role of loading calcitriol to control hypocalcemia after parathyroidectomy in chronic kidney disease. J Med Assoc Thai 94: 295-302.