Should Antibiotic Prophylaxis Be Given Prior to Thyroidectomy or Parathyroidectomy?

23

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Abstract

Although thyroid and parathyroid operations are very commonly performed, until recently there has been very little evidence to inform the decision of whether or not preoperative antibiotic prophylaxis should be given. It is interesting to note that while most surgeons would agree that clean operations that do not involve prosthetic implants do not generally require antibiotic prophylaxis, most endocrine surgeons give their patients preoperative antibiotic prophylaxis always or nearly always.

Keywords

Antibiotic prophylaxis · Thyroidectomy · Parathyroidectomy · Wound infection

Wound infections following thyroid or parathyroid operations are rare. Most large studies report a wound infection rate of less than 1%, although it is unknown whether that low infection rate is achieved with or without preoperative antibiotic prophylaxis. Recently, two prospective randomized trials have been reported on this subject [1, 2] (Table 23.1). Both studies, totaling more than 2500 patients did not demonstrate any benefit to antibiotic prophylaxis. Another retrospective study, reviewing more than 1000 patients, reached the same conclusion [3]. On the other hand, there are several reports of severe and occasionally lethal streptococcal infections following thyroid or parathyroid operations [4–8].

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Table 23.1 Summary of comparative studies evaluating the role of preoperative antibiotic prophylaxis in thyroidectomy and parathyroidectomy

Reference	Patients	Intervention	Comparator	Outcome
Urono [2]	(Prospective) patients who underwent thyroidectomy or parathyroidectomy	541—received piperacillin 541 received cefazolin	1082 received no antibiotic prophylaxis	No difference in SSI rate
Avenia [1]	(Prospective) patients who underwent thyroidectomy	250 received Ampicillin/ sulbactam	250 received no antibiotic prophylaxis	No difference in SSI
DePalma [3]	(Retrospective) patients who underwent thyroidectomy	1132 patients who received antibiotic prophylaxis	1794 received no antibiotic prophylaxis	No difference in SSI
Lu [19]	(Retrospective) patients who underwent thyroidectomy	1166 patients who received no antibiotic prophylaxis	None	One SSI
Dionigi [23]	(Prospective, nonrandomized)	50 patients who received first generation cephalosporin	191 received no antibiotic prophylaxis	No difference in SSI

SSI skin/soft tissue infection

To date, there are no data to support routine antibiotic prophylaxis prior to thyroid or parathyroid surgery. This decision should be individualized according to surgeon experience, previous results, and patient and operative considerations that may increase the risk for wound infection.

Thyroidectomy and parathyroidectomy together account for the vast majority of endocrine operations done, and are nearly always classified as clean cases. Although the routine use of prophylactic antibiotics is not generally recommended in clean cases, [9] the impact of a superficial or deep wound infection in a cervical incision can be great and the risk attributed to a single dose of antibiotics is low. Therefore, it remains controversial whether prophylactic antibiotics should be used prior to thyroidectomy or parathyroidectomy. Nevertheless, since the introduction of the Surgical Care Improvement Project (SCIP) in 2004, an active decision regarding the administration of preoperative antibiotics must be made in every case, and in cases where no antibiotics are given, justification must be documented in the chart.

As a recent international survey of endocrine surgeons has shown, there is substantial variation in practice patterns relating to the use of preoperative antibiotic prophylaxis prior to thyroid or parathyroid surgery: Nearly two thirds of endocrine surgeons stated that they used preoperative antibiotics almost always (more than 90% of the time) while 26% of endocrine surgeons stated that they used preoperative antibiotics almost never (less than 10%) prior to thyroidectomy or parathyroidectomy. In that study, surgeons who worked in Asia (58%) were more likely than their European (8.8%) or American (29%) counterparts to always or almost always give preoperative antibiotics. Surgeons who worked in community hospitals were more likely to almost always give antibiotics than those who worked in University or Affiliated medical centers [10].

In this chapter, the available evidence that pertains to this important question will be summarized and graded, with the hope that it will help surgeons make more individualized decisions regarding the use or the withholding of preoperative antibiotic prophylaxis prior to thyroid or parathyroid surgery.

Prevalence and Predictors of Wound Infections Following Thyroid or Parathyroid Surgery

A classic prospective study of more than 20,000 surgical wounds at a Minneapolis VA hospital was one of the most important in demonstrating the benefit of preoperative antibiotic prophylaxis in clean and clean- contaminated operations. In that study, the administration of antibiotic prophylaxis was associated with a reduction in wound infection rates from 5.1% to 0.8% in clean cases, and from 10.1% to 1.3% in clean—contaminated wounds [11].

Among large series of unselected patients who underwent thyroidectomy, low but highly variable wound infection rates have been reported. In the largest series of patients who underwent thyroidectomy, including nearly 15,000 patients in Italy, the wound infection rate was 0.3% [12]. A well- designed prospective study of postoperative complications after thyroidectomy for multinodular goiters also revealed an infection rate of 0.3% (1/300) [13].

A recent review of the American College of Surgeons' National Surgical Quality Improvement Program (ACS-NSQIP) user files between 2005 and 2011 again revealed a surgical site infection (SSI) rate of 0.36% (N = 179) among nearly 50,000 patients who underwent thyroidectomy. In that study, ¾ of the infections were classified as SSIs, and the rest were organ space infections or deep incisional infections. While preoperative factors such as obesity, alcohol use, and non-independent status were predictive of postoperative wound infection, these were not nearly as important as intraoperative variables that cannot always be predicted preoperatively. A wound classification of clean—contaminated (the result of intraoperative tracheal or esophageal injury) was by far the most predictive factor for wound infection (Odds ratio = 6.1), followed by prolonged operative time. No information is available regarding the use of antibiotic prophylaxis in the patients who were included in that study [14] (Table 23.2).

Table 23.2 Summary of non comparative studies

Author	Type	Major finding
Elfenbein [14]	#	OR time and wound classification were most predictive of postop SSI. Preop factors less predictive, included obesity, alcohol use, and non-independent status
Moalem [10]	@	Use of preoperative antibiotics varies widely and appears dogmatic (88% of endocrine surgeons use abx almost always (62%) or almost never (26%))
Hardy [6]	@	40% of surgeons had at least one patient with severe postthyroidectomy wound infection; 9% had at least one patient with necrotizing wound infection

= NSQIP review. @ = Survey study

Reasons (and Supportive Data) to Consider Administering Preoperative Antibiotics Routinely Prior to Thyroid or Parathyroid Surgery

Although thyroid and parathyroid operations are nearly always classified as clean cases, infections still occur. A recent survey of members of the British Association of Endocrine Surgeons revealed that 40 of 100 respondents to a survey had at least one patient with a severe wound infection that required intravenous antibiotics or surgical drainage. In addition, nine surgeons had patients with fulminant wound infections, of whom six died [6]. A study from France, where severe infections are reported to government authorities, described three cases of fulminant streptococcal infections, which were rapidly lethal in two patients (death occurred on postoperative days 4 and 12 despite intensive care and debridement), and resulted in a prolonged ICU stay in the third. Those three cases occurred in geographically distinct areas in France, and no causative factor was discovered [5]. In contrast, a report from the Center for Disease Control in the United States described an outbreak of severe necrotizing group-A strep among three patients who underwent thyroid and parathyroid surgery in late 1996 [4]. Two of those patients died from the infection, and the third was discharged after a prolonged ICU stay. All three cases were attributed to subclinical infection among health care workers who were in contact with the patients.

A few other case reports of severe streptococcal infections following thyroid surgery exist [7, 8]. Curiously, such devastating infections tend to affect young, fit adults who appear to have intact immunity and no known risk factors for infection [15].

Superficial wound infections are far more common than the necrotizing wound infections reported above. Among large series of outcome—related studies of thyroidectomy, wound infection is commonly not reported [16]. Nevertheless, some studies have revealed wound infection rates as high as 5.3% among patients who underwent conventional thyroidectomy [17]. In other series of patients who underwent clean surgery, infection rates as high as 16% have been reported among high—risk patients [18].

The cosmetically sensitive location of the scar (and therefore, of a potential wound infection) greatly increases the impact of an otherwise simple SSI, and also limits therapeutic options. Whereas, most superficial wound infections are readily treated with suture removal or incision and drainage, the proximity of the cervical incision to critical structures precludes open packing and regular dressing changes. Moreover, such treatment and healing by secondary intent can be associated with a suboptimal long-term cosmetic result in a highly visible and sensitive area.

Finally, in an era of protocol-driven care pathways, where substantial efforts to standardize care and reduce variability are made, some surgeons may be disincentivized to personalize care and simply order antibiotic prophylaxis routinely, per hospital perioperative policy.

Reasons (and Supportive Data) to Consider NOT Administering Preoperative Antibiotics Routinely Prior to Thyroid or Parathyroid Surgery

To date, no study has demonstrated benefit with the routine administration of prophylactic antibiotics. Three comparative studies have been done to address this question. A retrospective review recently compared 1132 patients who underwent thyroid surgery and received antibiotic prophylaxis to 1794 patients who did not. That study found an overall wound infection rate of 1%, but no difference between the two groups [3]. A recent prospective randomized study compared 1082 patients who underwent thyroid or parathyroid surgery and received antibiotic prophylaxis (evenly split between cefazolin and piperacillin) to 1082 patients who did not receive antibiotics. That study did not demonstrate a difference in SSI, with one SSI (0.09%) in the antibiotic group, and three (0.28%) in the no antibiotic group ($p = 0.371$). Interestingly, preoperative antibiotics were associated with a lower urinary tract infection (UTI) rate (3 vs. 17, $p = 0.002$) in this large cohort of patients. Notably, 84% of the UTI's in that series were in patients who had an indwelling urinary catheter [2].

Finally, a multicenter prospective randomized double blind study was conducted on 500 patients who underwent thyroidectomy. Half received ampicillin/sulbactam as prophylaxis, and half received none. No difference in SSI rate was found, with two infections in the antibiotic group, and only one in the no antibiotic group [1]. In addition, a large retrospective case series of patients who underwent thyroid operations without antibiotic prophylaxis reported a single infection among more than 1000 patients [19, 20]. These findings demonstrate that with meticulous technique, scrupulous maintenance of sterile conditions, and attention to hemostasis very low infection rates can be readily achieved even without antibiotic prophylaxis.

Recently, the overuse of antibiotic prophylaxis has been cited as a possible contributing factor to the development of antibiotic resistance [21, 22]. Additionally, adverse reactions such as renal or hepatic toxicity, allergic reactions, and the development of opportunistic infections are all possible even after a single dose of antibiotics. Taken together, one could easily argue that the societal and individual harm that is caused by routine, unnecessary antibiotic prophylaxis prior to these common and clean operations may be greater than the benefit that they are intended to confer.

Conclusions

Infections following thyroid or parathyroid operations are very uncommon, partly because of the clean nature of these operations, but also because of the very rich blood supply in the neck. To date, only two randomized studies have been done in an effort to determine the necessity of antibiotic prophylaxis prior to these operations. Both studies failed to show a benefit to antibiotic prophylaxis. On the other hand, there are a few case reports describing serious and even lethal wound

infections following thyroid and parathyroid operations. It is unclear whether antibiotic prophylaxis would prevent such infections, and in most of the reports is it not mentioned whether the patients received antibiotic prophylaxis [4–7].

Recommendations

There are no data to support the routine administration of preoperative antibiotic prophylaxis prior to thyroid or parathyroid operations. However, because of the paucity of level one data, and the wide range of wound infections reported in the literature, it is recommended that surgeons carefully scrutinize their own outcomes as it relates to wound infections and individualize this decision. Selective use of antibiotic prophylaxis may be appropriate, but to date, no preoperative patient factor (diabetes, obesity, immunocompromised patient) or operative factor (reoperation) has been proven to increase the risk of infection, or to be associated with increased benefit from preoperative antibiotic prophylaxis (grade B recommendation).

References

1. Avenia N, Sanguinetti A, Cirocchi R, Docimo G, Ragusa M, Ruggiero R, et al. Antibiotic prophylaxis in thyroid surgery: a preliminary multicentric Italian experience. Ann Surg Innov Res. 2009;3:10.
2. Uruno T, Masaki C, Suzuki A, Ohkuwa K, Shibuya H, Kitagawa W, et al. Antimicrobial prophylaxis for the prevention of surgical site infection after thyroid and parathyroid surgery: a prospective randomized trial. World J Surg. 2015;39(5):1282–7.
3. De Palma M, Grillo M, Borgia G, Pezzullo L, Lombardi CP, Gentile I. Antibiotic prophylaxis and risk of infections in thyroid surgery: results from a national study (UEC-Italian endocrine surgery units association). Updat Surg. 2013;65(3):213–6.
4. Control CD. Prevention. Nosocomial group a streptococcal infections associated with asymptomatic health-care workers--Maryland and California, 1997. MMWR Morb Mortal Wkly Rep. 1999;48(8):163.
5. Faibis F, Sapir D, Luis D, Laigneau P, Lepoutre A, Pospisil F, et al. Severe group a streptococcus infection after thyroidectomy: report of three cases and review. Surg Infect. 2008;9(5):529–31.
6. Hardy R, Forsythe J. Uncovering a rare but critical complication following thyroid surgery: an audit across the UK and Ireland. Thyroid. 2007;17(1):63–5.
7. Hung JA, Rajeev P. Streptococcal toxic shock syndrome following total thyroidectomy. Ann R Coll Surg Engl. 2013;95(7):457–60.
8. Karlik JB, Duron V, Mermel LA, Mazzaglia P. Severe group a streptococcus surgical site infection after thyroid lobectomy. Surg Infect. 2013;14(2):216–20.
9. Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health Syst Pharm. 2013;70(3):195–283.
10. Moalem J, Ruan DT, Farkas RL, Shen WT, Kebebew E, Duh QY, et al. Patterns of antibiotic prophylaxis use for thyroidectomy and parathyroidectomy: results of an international survey of endocrine surgeons. J Am Coll Surg. 2010;210(6):949–56.
11. Olson M, O'Connor M, Schwartz ML. Surgical wound infections. A 5-year prospective study of 20,193 wounds at the Minneapolis VA medical center. Ann Surg. 1984;199(3):253–9.
12. Rosato L, Avenia N, Bernante P, De Palma M, Gulino G, Nasi PG, et al. Complications of thyroid surgery: analysis of a multicentric study on 14,934 patients operated on in Italy over 5 years. World J Surg. 2004;28(3):271–6.

13. Zambudio AR, Rodríguez J, Riquelme J, Soria T, Canteras M, Parrilla P. Prospective study of postoperative complications after total thyroidectomy for multinodular goiters by surgeons with experience in endocrine surgery. Ann Surg. 2004;240(1):18.
14. Elfenbein DM, Schneider DF, Chen H, Sippel RS. Surgical site infection after thyroidectomy: a rare but significant complication. J Surg Res. 2014;190(1):170–6.
15. Martin PR, Høiby EA. Streptococcal Serogroup: a epidemic in Norway 1987–1988. Scand J Infect Dis. 1990;22(4):421–9.
16. Chadwick D. Fourth National Audit Report, The British Association of Endocrine and Thyroid Surgeons. 2012. Available at http://www.baets.org.uk/wp-content/uploads/2013/05/4th-National-Audit.pdf. Accessed 24 Mar 2015.
17. Dionigi G, Boni L, Rovera F, Rausei S, Dionigi R. Wound morbidity in mini-invasive thyroidectomy. Surg Endosc. 2011;25(1):62–7.
18. Haley RW, Culver DH, Morgan WM, White JW, Emori TG, Hooton TM. Identifying patients at high risk of surgical wound infection: a simple multivariate index of patient susceptibility and wound contamination. Am J Epidemiol. 1985;121(2):206–15.
19. Lu Q, Xie S-Q, Chen S-Y, Chen L-J, Qin Q. Experience of 1166 thyroidectomy without use of prophylactic antibiotic. Biomed Res Int. 2014;2014:1–5.
20. Qin Q, Li H, Wang L-B, Li A-H, Chen L-J, Lu Q. Thyroid surgery without antibiotic prophylaxis: experiences with 1,030 patients from a teaching hospital in China. World J Surg. 2014;38(4):878–81.
21. Porco TC, Gao D, Scott JC, Shim E, Enanoria WT, Galvani AP, et al. When does overuse of antibiotics become a tragedy of the commons? PLoS One. 2012;7(12):e46505.
22. Davey P, Brown E, Charani E, Fenelon L, Gould IM, Holmes A, et al. Interventions to improve antibiotic prescribing practices for hospital inpatients. Cochrane Libr. 2013.
23. Dionigi G, Rovera F, Boni L, Castano P, Dionigi R. Surgical site infections after thyroidectomy. Surg Infect. 2006;7(Supplement 2):s-117–s-20.