Article

Dexamethasone Use in the Treatment of Pediatric Deep Neck Space Infections

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Abstract

Objectives: Assess the outcome of Intravenous (IV) dexamethasone in the treatment of pediatric deep neck space infections (DNSI) in combination with IV antibiotics.

Methods: Retrospective chart review of pediatric patients admitted for a DNSI from March 2014 to June 2016. Patient characteristics including demographics, abscess type, antibiotic, dexamethasone, surgery, culture, and length of stay (LOS) were obtained. Patients treated with antibiotics alone versus antibiotics and dexamethasone were compared. Primary outcome measures were rate of surgical drainage and LOS.

Results: Overall 153 patients with DNSI were identified, including 62 lateral neck, 18 parapharyngeal, 40 peritonsillar, 32 retropharyngeal, and 1 submandibular. All patients received antibiotics. Dexamethasone was used in 35% of patients. The rate of surgical drainage in the dexamethasone and non-dexamethasone group was 36% and 53% respectively ($P = .043$). LOS was shorter for the dexamethasone group (2.9 days) compared to the non-dexamethasone group (3.8 days) but was non-significant, *P*-value-.09. The most common microorganisms cultured were MRSA (25), MSSA (11), and Streptococcus pyogenes (10).

Conclusion: Dexamethasone use was associated with a decreased rate of surgical drainage in pediatric patients with DNSI. Further prospective study is needed to determine the role of dexamethasone in treatment.

Keywords

pediatric neck abscess, steroids, antibiotics, microbiology, surgery

Introduction

Deep neck space infections (DNSI), although relatively uncommon in the general population, are frequently seen in the pediatric hospital setting and make up 1-2% of all hospitalizations.[1] Common presenting symptoms include a tender neck mass, dysphagia, odynophagia, fever, trismus and decreased neck range of motion.[2] Although most patients recover uneventfully, if left untreated, DNSI can lead to serious complications.

Past treatment paradigms called for early incision and drainage. However, more recent studies have shown success treating medically with intravenous (IV) antibiotics.[3] In the pediatric population, it has been shown that there is no difference in complication rate with delayed versus early surgical drainage.[4] For this reason, it is common at our institution to treat patients with a trial of 48 hours of antibiotics prior to deciding on surgical drainage.

There have been few studies discussing the efficacy of steroids in the treatment of DNSI. Research has mostly focused on adults with peritonsillar abscesses and shown decreased pain, decreased dysphagia and an increase in discharge rate when antibiotics were combined with steroids.[5,6] Currently, there is a lack of data for steroid use in children with DNSI.

Our goal is to assess the outcomes of patients with DNSI by comparing patients treated with antibiotics alone to patients treated with antibiotics and dexamethasone.

Methods

We performed a retrospective chart review of patients less than 18 years old admitted for a DNSI between March 2014 and June 2016. The Institutional Review Board approved this study. Patients with ICD codes for deep cervical abscess (lateral neck abscess), retropharyngeal abscess, peritonsillar

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abscess, parapharyngeal abscess and salivary gland abscess were included (682.9, 478.24, 475, and 527.3). Patients with mediastinal spread, immune deficiency, abscess recurrence or whose abscess was drained in the emergency department were excluded. Patient characteristics including demographics, abscess subsite, greatest dimension of abscess, antibiotic(s) used, dexamethasone use, surgical drainage, culture and length of hospital stay were obtained. Primary outcome measures were rate of surgical drainage and length of hospital stay. Patients treated with antibiotics alone versus antibiotics and dexamethasone was compared. The means for the quantitative data listed for both groups were compared using 2-tailed Students *T* Test. ANOVA was used when comparing the means for the different subsites for abscesses. Lastly, Chi-Square test was used for categorical data. Confidence intervals were calculated when applicable. A *P*-value of ≤.05 was considered significant in this study.

Table 1. Demographics and Lab Values for Steroid and Non-Steroid Groups.

	Steroid	No Steroid	*P*-Value
Gender			
Male	30 (19.6%)	47 (30.7%)	.258
Female	23 (15%)	53 (34.7%)	
Race			
White	13 (8.5%)	25 (16.3%)	.99
Black	35 (22.9%)	65 (42.5%)	
Other	5 (3.3%)	10 (6.5%)	
Age (years)	7.42	4.65	.0005*
Weight (kg)	33.7	22.1	.0027*
Height (cm)	124.2	101.8	.0001*
Max Temp (Celsius)	38.3	38.4	.311
WBC (In thousands)	19.1	18.8	.777
Greatest Dimension (cm)	2.8	2.5	.127

*indicates $P < .05$.

Results

Overall there were 153 patients admitted to Le Bonheur Children's Hospital between March 2014 and June 2016 for DNSI that met the inclusion criteria. Of these patients, there were 77 (50.3%) males and 76 (49.7%) females. In regards to race, 100 (65.4%) were black, 38 (24.8%) were white, and 15 (9.8%) were other, which included Latino and Asian. Age ranged from 2 weeks to 18 years with the mean age being 5.6 years (Table 1). All patients received IV antibiotics, most with dual therapy. Clindamycin (98.0%), ceftriaxone (88.9%), and vancomycin (18.3%) were most common antibiotics used. Among the entire group studied, 53 (34.6%) received dexamethasone. Dexamethasone was dosed 1 mg/kg up to 10 mg and was given every 8 hours for up to 48 hours depending on patient improvement. Between the two groups there was no difference in greatest dimension of abscess, maximum temperature during the first 24 hours, initial white blood cell count, sex, race, or ethnicity. However, there was a significant difference in age, height, and weight with the average age of the dexamethasone group being 7.4 years and the non-dexamethasone group being 4.65 ($P = <.001$) outlined in Table 1.

When looking at all patients studied, those treated with dexamethasone were less likely to require incision and drainage compared to the non-dexamethasone group, 19/53 (35.8%) and 53/100 (53%) respectively, $P = .043$ [3.29, 109.2]. Overall, there was no significant difference in regards to average length of hospital stay, with the dexamethasone group averaging 2.9 days and the non-dexamethasone group averaging 3.8 days, $P = .09$ [−2.94, 9.63]. Rates of incision and drainage as well as length of hospital stay for both dexamethasone and non-dexamethasone groups are outlined in Tables 2 and 3.

When categorizing by subsite, 62 (40.5%) presented with lateral neck abscess, 40 (26.1%) with peritonsillar abscess, 32 (20.9%) with retropharyngeal abscess, 18 (11.8%) with parapharyngeal abscess, and 1 (0.7%) with salivary gland abscess. Dexamethasone utilization was significantly different between subsites with 3 (5.7%) lateral neck, 16 (30.2%) retropharyngeal, 10 (18.9%) parapharyngeal, and 24 (45.2%) peritonsillar abscesses receiving dexamethasone ($P < .001$). The average age at presentation varied between subsites with lateral neck being 3.0 years, retropharyngeal being 4.5 years, parapharyngeal being 5.4 years, and peritonsillar being 10.6 years ($P < .001$).

Rate of surgical drainage by subsite was 35/62 (56%) for lateral neck, 14/32 (44%) for retropharyngeal, 5/18 (28%) for parapharyngeal, and 15/40 (38%) for peritonsillar ($P = .096$) (Table 2). Overall, there was a significant difference in length of hospital stay between peritonsillar abscesses (2.0 days) and those with lateral neck, retropharyngeal, and parapharyngeal abscesses (4.32, 3.78, 3.48 days respectively), $P < .001$.

When controlling for subsite, there was a significant difference with peritonsillar abscesses when comparing need for incision and drainage for steroid versus non-steroid groups with *P*-value of .04 [1.12, 26.37]. There were no other significant differences in surgical drainage or length of stay between the dexamethasone and non-dexamethasone groups when controlling for subsite (Tables 2 and 3).

Cultures from those patients who underwent surgery most commonly grew MRSA (25), MSSA (11), and Strep Pyogenes (10). No complications occurred while being treated with dexamethasone.

Discussion

Pediatric deep neck space infections are a relatively rare occurrence, occurring at a rate of 4.6 per 100,000 children in 2009.[7] However, they accounted for more than $75 million

Table 2. Incidence of Incision and Drainage for Steroid and Non-Steroid Groups.

		Incidence	*P*-Value	95% Confidence Interval
All	Steroid	19/53 (35.8%)	.043*	[3.29, 109.2]
	No Steroid	53/100 (53%)		
Lateral Neck	Steroid	1/3 (33%)	.177	[−19.76, 68.25]
	No Steroid	34/59 (57.6%)		
Parapharyngeal	Steroid	3/10 (30%)	.05	[−0.4, 11.89]
	No Steroid	2/8 (25%)		
Peritonsillar	Steroid	8/24 (33%)	.04*	[1.12, 26.37]
	No Steroid	7/16 (43.8%)		
Retropharyngeal	Steroid	7/16 (43.8%)	1	[3.23, 19.76]
	No Steroid	7/16 (43.8%)		

Note. *indicates $P < .05$. Confidence Intervals are generated for statistical analysis. Confidence Intervals that include 1 are considered non-significant.

Table 3. Length of Stay for Steroid and Non-Steroid Groups.

		Length of Stay (days)	*P*-Value	95% Confidence Interval
All	Steroid	2.85	.09	[−2.94, 9.63]
	No Steroid	3.84		
Lateral Neck	Steroid	2.65	.15	[−7.59, 14.64]
	No Steroid	4.40		
Parapharyngeal	Steroid	2.64	.16	[−8.48, 15.66]
	No Steroid	4.54		
Peritonsillar	Steroid	2.14	.05	[−0.25, 4.18]
	No Steroid	1.79		
Retropharyngeal	Steroid	4.09	.05	[−0.15, 7.71]
	No Steroid	3.47		

Note. *indicates $P < .05$. Confidence Intervals are generated for statistical analysis. Confidence Intervals that include 1 are considered non-significant.

in hospital charges for these patients, with the largest financial burden on those patients who underwent surgical drainage versus medical management. Those patients who underwent surgical management, additionally had a longer length of stay associated with their hospitalization.

In the past, early surgical intervention has been recommended for pediatric DNSI but more recent literature has shown the efficacy of treatment with empiric antibiotic therapy. Antibiotic therapy has been shown to be an effective initial intervention in a meta-analysis, although with a low level of evidence.[3] Additionally, no difference was found in the rate of complications between early and delayed surgical intervention.[4] There have also been attempts at identifying clinical characteristics that would help identify which patients should undergo early surgical drainage. There is some evidence that abscess size greater than 2.2 cm and age less than 4 would lead to a likely medical failure.[8]

There is a paucity of literature on the use of dexamethasone as an adjunctive treatment to antibiotic therapy in DNSI. A systematic review on the use of dexamethasone in peritonsillar abscesses suggested that steroids may decrease the length of stay when combined with antibiotic therapy.[6] Controversy exists on the use of steroids in the realm of head and neck infections due to the immunosuppressive effects of steroids. However, Lee *et al*., reported the use of steroids for peritsonillar abscesses in combination with antibiotics produced a positive outcome. Used initially for pain control in the setting of edema produced by peritonsillar abscesses, steroids were found to produce a synergistic effect on treating abscesses that lead to better outcomes. It is unknown how this synergism is produced, however, despite the shortage of literature on the effectiveness of dexamethasone use in deep neck infections, there is evidence that this treatment is efficacious in other types of infection.[5,6]

There is a limited amount of literature on the use of dexamethasone in the treatment of bacterial infections. The use of dexamethasone in the treatment of pleural effusions appeared safe and effective.[9] A study comparing patients with orbital cellulitis evaluated IV dexamethasone use in addition to antibiotics alone and compared these patients to a group receiving only antibiotic therapy. A shorter length of stay was identified in those patients who received IV dexamethasone therapy, but there did not appear to be difference in rate of surgical intervention.[10]

The goal of our study was to examine whether IV dexamethasone therapy when combined with empiric antibiotic therapy resulted in better outcomes when compared to empiric antibiotic therapy alone when looking at length of stay and rate of surgical intervention. Our data showed that dexamethasone use is associated with a decrease in the frequency of surgical drainage when looking at all of the DNSI that presented to our institution between March 2014 and June 2016. However, when controlling for subsite, the only statistically significant association was between dexamethasone use and decreased need for surgical drainage in patients with peritonsillar abscesses. Although rate of surgical intervention for lateral neck abscesses in dexamethasone-treated and non-dexamethasone treated patients appears to be significantly different, the small sample size of lateral neck abscesses receiving steroids contributes to a non-significant calculation.

One possible explanation for this is that our data is not sufficiently powered when it is broken down by subsite. The confounding age difference between the dexamethasone group and non-dexamethasone group must be acknowledged. This is largely due to the fact that lateral neck abscesses tended to present in younger children who were much less likely to receive dexamethasone whereas patients with peritonsillar abscesses tended to present in older children who were much more likely to receive steroids.

The differences in subsite pathophysiology, patient population and treatment paradigms necessitate further research with each subsite being powered sufficiently to assess for any improved outcomes with dexamethasone use. This would allow for further standardization in the medical management of the pediatric DSNI.

Conclusion

Medical management is preferable to surgical intervention in pediatric DNSI. However, most research has thus far focused on empiric antibiotic therapy with decreased focus on the effectiveness of dexamethasone use. This may be due to the fact that when used inappropriately, dexamethasone may actually lead to higher rates of infection and other complications. However, when used in appropriate situations, dexamethasone may be an effective adjunct in treating certain types of infection. While retrospective in nature, our study does show some benefit in the use of dexamethasone therapy in addition to IV antibiotic therapy for rate of surgical intervention in our patients. A prospective study comparing patients receiving IV antibiotic therapy and dexamethasone therapy with patient receiving IV antibiotic therapy alone would be beneficial in helping define the role of dexamethasone use in these patients.

Declaration of Conflicting Interests

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References

1. Cabrera CE, Deutsch ES, Eppes S, et al. Increased incidence of head and neck abscesses in children. *Otolaryngol Head Neck Surg*. 2007;136(2):176-181.
2. Cmejrek RC, Coticchia JM, Arnold JE. Presentation, diagnosis and management of deep-neck abscesses in infants. *Arch Otolaryngol Head Neck Surg*. 2002;128(12):1361-1364.
3. Carbone PN, Capra GG, Brigger MT. Antibiotic therapy for pediatric neck abscesses. A systematic review. *Int J Pediatr Otorhinolaryngol*. 2012;76(11):1647-1653.
4. Cramer JD, Purkey MR, Smith SS, Schroeder JW Jr. The impact of delayed surgical drainage of deep neck abscesses in adult and pediatric populations. *Laryngoscope*. 2016;126(8):1753-1760.
5. Lee YJ, Jeong YM, Lee HS, Hwang SH. The efficacy of corticosteroids in the treatment of peritonsillar abscess: a meta-analysis. *Clin Exp Otorhinolaryngol*. 2016;9(2):89-97.
6. Hur K, Zhou S, Kysh L. Adjunct steroids in the treatment of peritonsillar abscess: a systematic review. *Laryngoscope*. 2018;128(1):72-77.
7. Adil E, Tarshish Y, Roberson D, Jang J, Licameli G, Kenna M. The public health impact of pediatric deep neck infections. *Otolaryngol Head Neck Surg*. 2015;153(6):1036-1041.
8. Lawrence R, Bateman N. Controversies in the management of deep neck space infection in children: an evidence based review. *Clin Otolaryngol*. 2017;42(1):156-163.
9. Tagarro A, Otheo E, Baquero-Artigao F, et al. Dexamethasone for parapneumonic pleural effusion: a randomized, double-blind, clinical trial. *J Pediatr*. 2017;185:117-123.e6.
10. Chen L, Silverman N, Wu A, Shinder R. Intravenous steroids with antibiotics on admission for children with orbital cellulitis. *Ophthalmic Plast Reconstr Surg*. 2018;34(3):205-208.