American Journal of Emergency Medicine 37 (2019) 109–113

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Original Contribution

Predictors of a drainable suppurative adenitis among children presenting with cervical adenopathy

Amir A. Kimia, MD *, Tiffany F. Rudloe, MD, Nadine Aprahamian, MD, Jennifer McNamara, PNP, David Roberson, MD, Assaf Landschaft, MSc, Jennifer Vaughn, MD, Marvin B. Harper, MD

Boston Children's Hospital, United States

ARTICLE INFO

Article history:
Received 14 March 2018
Received in revised form 25 April 2018
Accepted 5 May 2018

Keywords:
Adenopathy
Cervical
Suppurative
Adenitis

ABSTRACT

Objectives: We sought to identify predictors for a drainable suppurative adenitis [DSA] among patients presenting with acute cervical lymphadenitis.
Methods: A retrospective cross sectional study of all patients admitted to an urban pediatric tertiary care emergency department over a 15 year period. Otherwise healthy patients who underwent imaging for an evaluation of cervical lymphadenitis were included. Cases were identified using a text-search module followed by manual review. We excluded immunocompromised patients and those with lymphadenopathy felt to be not directly infected (i.e. reactive) or that was not acute (symptom duration >28 days). Data collected included: age, gender, duration of symptoms, highest recorded temperature, physical exam findings, laboratory and imaging results, and surgical findings. A DSA was defined as >1.5 cm in diameter on imaging. We performed binary logistic regression to determine independent clinical predictors of a DSA.
Results: Three hundred sixty-one patients met inclusion criteria. Three hundred six patients (85%) had a CT scan, 55 (15%) had an ultrasound and 33 (9%) had both. DSA was identified in 71 (20%) patients. Clinical features independently associated with a DSA included absence of clinical pharyngitis, WBC >15,000/mm^3, age ≤3 years, anterior cervical chain location, largest palpable diameter on exam >3 cm and prior antibiotic treatment of >24 h. The presence of fever, skin erythema, or fluctuance on examination, was not found to be predictive of DSA.
Conclusions: We identified independent predictors of DSA among children presenting with cervical adenitis. Risk can be stratified into risk groups based on these clinical features.

1. Introduction

Cervical lymphadenopathy is a common pediatric complaint, raising concern for infection, autoimmune disease, or malignancy [1-3]. In the context of an infection, a local inflammatory process may result in reactive lymphoid hyperplasia [3]. This response normally functions to prevent microbial invasion of the host. However, bacterial inoculation of lymphatic tissue can occur, resulting in a local suppurative process [1,4-6]. Pathogens most commonly arise from the oropharynx, sinuses, or the nares [4,7]. Antibiotic therapy is often effective and selected to provide coverage for staphylococcal and streptococcal species [1,5,6,8].

Once liquefaction has occurred, surgical drainage may be necessary to mitigate the risk for spread of the infection beyond the node and into the deep soft tissues of the neck [9]. Factors previously shown to be associated with need for surgical drainage include unilateral lymph node, age <1 year, and duration of symptoms >48 h [10,11].

When drainage is being considered, either by needle aspiration [7,12] or by incision and drainage Ultrasound (US) or Computed Tomography (CT) imaging is often obtained [11,13]. Decisions on imaging beyond bedside ultrasound, are dependent upon clinical impression considering factors such as overlying erythema or fluctuance on exam, as with the evaluation of skin and soft-tissue abscess assessment. CT may also be obtained to guide surgical intervention and to assess potential airway compromise. There are clear reasons to avoid the radiation risk associated with CT of the neck as children are much more susceptible to the detrimental effects of radiation exposure compared to adults, with the thyroid gland being particularly sensitive to radiation exposure [14,15].

The primary goal of this study was to identify clinical predictors of a lymph node that has undergone suppuration, forming a drainable

* Corresponding author at: Boston Children's Hospital, Division of Emergency Medicine, 300 Longwood Ave., Boston, MA 02115, United States.
E-mail addresses: Amir.kimia@childrens.harvard.edu, (A.A. Kimia), Nadine.aprahamian@childrens.harvard.edu, (N. Aprahamian), Jennifer.mcnamara@childrens.harvard.edu, (J. McNamara), David.roberson@childrens.harvard.edu, (D. Roberson), Jennifer.vaughn@childrens.harvard.edu, (J. Vaughn), Marvin.harper@childrens.harvard.edu (M.B. Harper).

https://doi.org/10.1016/j.ajem.2018.05.004
0735-6757/

suppurative adenitis (see outcome definitions). Once identified, these factors could be used to more selectively obtain imaging, targeting those who may need drainage on an emergent basis.

2. Methods

2.1. Study design

This is a retrospective cross-sectional study of consecutive patients seen at an urban tertiary care pediatric emergency department (ED). The ED serves approximately 50,000 children per year. ED electronic medical records (EMR) of all patients presenting over a 15 year period with cervical lymphadenitis were reviewed.

2.2. Study population

We included patients who had neck US or CT imaging to evaluate a neck mass or swelling. Patients included met the following criteria: they were otherwise healthy, had a chief complaint of acute cervical neck swelling (or a mass felt to be concerning for lymphadenitis), and had imaging within 24 h of ED admission. Patients were excluded if they had chronic symptoms (>28 days), underlying immunodeficiency, or a known anatomic malformation in the region.

To assure exclusion of non-infectious adenitis or adenopathy, we excluded patients who were evaluated for reactive adenopathy (rheumatologic disease, suspected malignancy) and patients that were not treated with or prescribed antibiotics, during or after the encounter. Cases where there was a broad differential diagnosis, such as Kawasaki's disease or lymphoma, were excluded. For example, patients with a neck mass who had an oncology consultation or underwent imaging due to concern for tumor were not included. Such cases were excluded only after inter-reviewer agreement. Repeat visits were excluded if they occurred within 24 h of the initial visit or if there were no changes in clinical variables.

Three authors were assigned to perform the manual review to assure inter-reviewer agreement on included cases using the above criteria. Cases in which there was disagreement among the reviewers were resolved by consensus among the group.

2.2.1. Case identification

Case identification was conducted in two phases. First, for the initial screening, we created a computer-assisted screening tool similar to key word search tools, only using *regular expressions* [16,17]. The technique of regular expression matching provides a more comprehensive and inclusive search than key word searching by including possible misspelled and mistyped variations of the key word(s) of interest. The second step was a manual chart review of those patients identified by the screening tool, using the inclusion and exclusion criteria above.

2.3. Definitions

We divided our clinical and laboratory data into binary results representing either presence or absence of a finding. *Fever* was defined as any temperature of >38°C. *Age* was treated as a binary variable as age younger than 3 years is an age where streptococcal pharyngitis is an unlikely cause of reactive adenopathy. *Prior antibiotic treatment* was considered present if any oral or intravenous antibiotic had been administered for >24 h prior to the ED visit. *Location* was recorded as generalized cervical, anterior cervical, submandibular, posterior cervical, posterior auricular and then analyzed as a binary outcome of anterior or posterior location. *Size* was defined as the single largest recorded diameter in centimeters. *Erythema*, *tenderness*, *fluctuance*, *mobility*, and *warmth* were recorded as present or absent. Erythema and fluctuance were grouped together as a single category, and also analyzed separately. *Pharyngitis* was recorded as present (exudative or non-exudative), or absent. *Torticollis or limitation of neck range of motion* was recorded as present or absent. If a variable was not documented in the EMR, it was coded as not present. *Streptococcal positive* was considered positive by rapid antigen test or growth of Group A streptococci from throat culture.

If a trainee was involved in the patient care, both the trainee and the attending physician's notes were reviewed. Findings were considered present if they were documented either by the resident or attending physician. All cases were reviewed to screen for a second ED visit or hospital admission within a week of the index visit. Three reviewers extracted the variables, and one reviewer then reviewed all charts. A kappa score was calculated for inter-reviewer agreement.

2.4. Outcome measures

Our primary binary outcome is *drainable suppurative adenitis* [*DSA*]. In the absence of published consensus on what is DSA based on size, the authors defined DSA as a collection where the largest diameter on imaging was greater than or equal to 1.5 centimeter (cm) on imaging. We constructed this definition a-priori, after polling our surgical staff from ORL (otolaryngology), radiology and ED staff. Our primary outcome variable, DSA, was defined by size on imaging regardless of whether a surgical intervention took place.

Detailed imaging based definitions: For *CT imaging* - rim enhancing fluid attenuation collections in the neck including both intra-nodal and extra-nodal collections where the largest diameter of the collection measures greater than or equal to 1.5 cm. For *ultrasound* cases - positive cases were identified based on the presence of an anechoic or hypoechoic fluid collection in the neck with absence of internal flow including both intra-nodal and extra-nodal collections, where the largest diameter of the fluid collection measured greater than or equal to 1.5 cm.

Since this a priori definition has not been independently validated we planned secondary analyses with two alternate binary outcomes: *the presence of any abscess*, and *any surgical drainage*.

2.5. Statistical analysis

Data were analyzed using IBM SPSS for Windows V23 (Chicago, 2015). Univariate analyses were used followed by a binary logistic regression to determine independent clinical predictors of a drainable suppurative adenitis.

3. Results

3.1. Study group

During the study period there were 742,361 ED visits with electronic ED notes available for review. Three hundred sixty-one patients met study criteria. See Fig. 1 for case identification. Table 1 lists the patient demographics and clinical characteristics of patients who met study criteria.

CT scan was obtained in 306 patients (85%), 55 (15%) had an ultrasound and 33 (9%) had both. Our primary outcome of DSA was identified in 71 (20%) patients. Of those who had an ultrasound alone, 8 had an abscess identified on ultrasound, and 5 of these met criteria for DSA (≥1.5 cm). Of those who underwent CT scan, 84 had DSA identified, and 68 of these met criteria for DSA.

3.2. Clinical course

Two hundred forty-six patients had ORL consultations. Two hundred eighty-nine patients were admitted, and 72 had surgical drainage. Three patients had needle aspiration. Microbiology results were available for 70 patients. Results of culture are shown in Table 2. It should be noted that there were 15 patients who did not have a “drainable suppurative adenitis” per our definition, but did undergo a surgical procedure, and

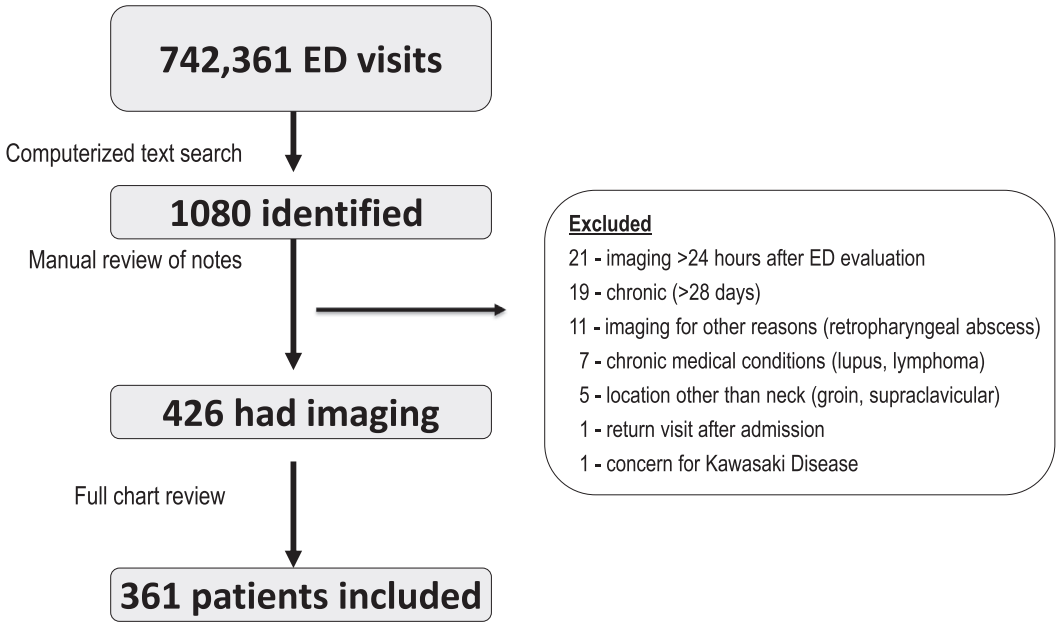

Fig. 1. Selection of Study Patients.

14 patients who met the definition but did not have drainage but were treated with systemic antibiotics alone. Of the 14 patients who met our definition and did not have surgical drainage at the index hospitalization, 2 returned within one week of discharge and one had a surgical drainage. None of the other patients returned to our ED within a week of the index visit.

The performance of our pre-determined cut-off of 1.5 cm in predicting a surgical intervention shows a sensitivity of 81% and specificity of 96% with a positive predictive value of 86% and a negative predictive value of 96%.

3.3. Statistical analysis

On univariate analysis, variables associated with a DSA are shown in Table 3. A multivariate model is presented in Table 4.

Table 1
Patient demographics.

Included patients		N = 361	
Demographics			
Age (years)	Median [IQR]	4	[2, 8]
Female	Number %	162	45
Fever ≥38.0	Number %	226	63
Duration of symptoms (days)	Median [IQR]	3	[2, 6]
Pretreated with antibiotics[a]	Number %	208	58
Physical exam			
Erythema	Number %	93	26
Fluctuance	Number %	25	7
Warmth	Number %	39	11
Anterior location	Number %	280	78
Size ≥3 cm	Number %	255	71
Pharyngitis on exam	Number %	86	24
Limited neck ROM	Number %	79	22
Lab results			
WBC (cells/mm^3) (329 patients)	Median [IQR]	16.1	[10.9, 21]
ANC (cells/mm^3) (278 patients)	Median [IQR]	11.9	[6.9, 16.3]
Mononucleosis positive[b]	Number %	11/97	11
Streptococcus positive[c]	Number %	21/209	10
ESR (102 patients)	Median [IQR]	57	[34, 82]
CRP (57 patients)	Median [IQR]	4.8	[1.2, 10.8]

[a] 24 h of systemic antibiotics.
[b] Either monospot or positive IgM.
[c] Either by positive antigen test, or culture.

3.4. Scoring system and performance

Based on the models above we are offering a scoring system as follows: Age ≤3 years and absence of clinical pharyngitis receive 2 points each, while WBC ≥15,000 cells/mm^3 and prior antibiotics receive one point each (Table 5). The performance of this prediction score appears in Table 6. Pearson Chi-square P value < 0.001 for all three outcomes.

4. Discussion

We have identified clinical predictors of a DSA among children with acute cervical lymphadenitis who underwent CT or US imaging. Three outcomes offered, two were objective (presence of suppurative adenitis, and presence of suppurative adenitis with an imaging diameter >1.5 cm) and one subjective (surgeons decision to perform surgical drainage). We believe that identifying children at high risk for an abscess will have an impact on the management plan, regardless of which management strategy is chosen, as some surgical drainage is often required [18-20]. Other management options include admission for monitoring and antibiotic treatment or imaging guided needle aspiration.

4.1. Predictors we identified which may be useful to aid decision making

Age of <3 years is associated with increased risk of a drainable suppurative adenitis. We defined an age cut off of 3 years of age a priori. Previous studies which have also shown that younger age is associated

Table 2
Bacterial isolates from suppurative lymph nodes. No growth was detected among surgical specimens from ten patients.

Organism	Number of isolate	
Staphylococcus aureus		41
Methicillin susceptible	34	
Methicillin resistant	7	
Streptococcus pyogenes		6
Streptococcus intermedius		5
Multiple organisms (>1 organism listed above)		4
Contaminant (skin flora)		2
Haemophilous influenzae non-typeable		1

Table 3
Univariate analysis across outcomes.

Predictor	Drainable abscess[a] (diameter ≥1.5 cm)		Presence of any abscess		Surgical intervention	
	Risk ratio	95% C.I.	Risk ratio	95% C.I.	Risk ratio	95% C.I.
No clinical pharyngitis	5.3	1.9, 15.2	5.4	2.1, 13.8	1.6	0.9, 2.9
Age ≤3 years	4.5	2.6, 7.9	5.5	3.2, 9.3	1.8	1.4, 2.2
WBC count >15 k/mm^3	4.3	2.2, 8.3	5.0	2.7, 9.2	3.0	1.9, 4.9
Anterior vs. posterior chain location	3.2	1.1, 9.1	2.5	1.03, 6.1	3.2	1.5, 7.1
Size ≥3 cm on clinical exam/assessment	2.9	1.3, 6.7	2.3	1.1, 4.8	1.9	1.05, 3.4
Prior antibiotics[b]	2.1	1.2, 3.8	1.9	1.1, 3.2	1.5	0.96, 2.35
Erythema or fluctuance	2.4	1.1, 5.0	1.8	0.9, 3.4	1.1	0.6, 2.1
Female gender	1.1	1.1, 3.2	1.8	1.1, 2.9	0.7	0.4, 1.1
Temperature ≥38°C	1.3	0.8, 2.3	1.3	0.8, 2.2	1.5	0.9, 2.3
Torticollis	1.3	0.1, 15.2	0.9	0.1, 10.1	2.0	0.2, 16.3

[a] Abscess used to describe drainable suppurative adenitis for short.
[b] Prior antibiotic treatment (over 24 h of systemic antibiotics prior to assessment).

with higher risk of abscess. Luu et al. reported that age <1 year, longer duration of symptoms (>48 h), and unilateral symptoms were associated with a need for surgical drainage [10]. Wetmore et al., showed that children who require surgical drainage tend to be younger and have a longer duration of hospital stay [13].

Anterior cervical and submandibular lymph nodes are more likely to suppurate and form an abscess, compared with posterior cervical or posterior auricular locations [11]. Similarly *Failure to improve on a trial of oral antibiotic therapy* was shown to be associated with suppuration [11].

Elevated WBC count. Unlike some prior publications our data reveal that an elevated peripheral blood WBC count is a strong independent predictor for a drainable suppurative adenitis. While not specifically evaluating the role in identifying drainable suppurative adenitis, Gosche et al. did not find WBC count (or CRP) to be helpful in making a diagnosis of an infection when used in isolation [11].

The presence of fever, torticollis or neck stiffness appears to be of minor significance in predicting a DSA which is in keeping with prior reports. Wetmore et al. reported that superficial suppurative collections rarely manifest with drooling, neck stiffness, or fever [13].

Our data suggest that clinical factors such as fluctuance and erythema are not reliably present even when DSA is found on imaging studies. Furthermore they may also be found in the absence of a DSA (i.e. they are neither sensitive nor specific). The variability may have to do with provider experience, difficulty in examination of an uncomfortable child [4], or accuracy of documentation.

Table 4
Multivariate analysis, across all three outcomes.

	Adjusted Odds ratio	95% Confidence interval
Predicting a drainable abscess (diameter ≥1.5 cm)		
Absence of clinical pharyngitis	5.3	1.5, 18.8
WBC ≥15 k/mm^3	4.2	2.0, 9.2
Age younger than 3 years	3.3	1.6, 6.5
Anterior vs. posterior chains	3.3	1.05, 10.6
Clinical measurement ≥3 cm	2.7	1.01, 7.2
Prior antibiotic treatment	2.3	1.1, 4.6
Predicting any abscess		
Absence of clinical pharyngitis	5.6	2.1, 5.2
WBC ≥15 k/mm^3	5.3	2.6, 10.6
Age younger than 3 years	3.3	1.8, 6.1
Anterior vs. posterior chains	3.1	1.1, 8.2
Prior antibiotic treatment	2.6	1.4, 4.8
Predicting surgical drainage		
Anterior vs. posterior chains	4.3	1.8, 10.4
WBC ≥15 k/mm^3	2.8	1.7, 4.9
Age younger than 3 years	2.6	1.6, 4.4
Prior antibiotic treatment	1.8	1.1, 3.0

The type of imaging recommended for those patients suspected of having an abscess (ultrasound vs. CT) depend in part on the type of surgical drainage considered [22]. In our facility it has been routine to obtain imaging prior to surgical drainage, most commonly with CT. Ultrasound may suffice if a needle aspiration is considered [7,12] although CT may be useful to detect unsuspected deep loculations and determine the extent of the infection for surgical planning [4,13]. Unfortunately, CT brings the risks associated with radiation exposure and unfortunately CT findings do not always correlate with surgical findings. Therefore, despite our study definition of drainable suppurative adenitis, we understand that other clinical factors will impact upon the use of imaging and the decision to perform surgical drainage [13,21]. Kirse and Roberson have argued that CT is important because it will at times disclose the presence of an unanticipated retropharyngeal abscess [23].

Among our patients with drainage *Staphylococcus aureus* accounted for two thirds of the identified pathogens. Methicillin resistant *S. aureus* (MRSA) accounted for 17% of the *S. aureus*. The frequency of MRSA has varied widely in other studies [24,25].

Limitations: 1) As a retrospective study our data depends on the quality of the clinical documentation. 2) While we have defined DSA our definition has not been validated. 3) Some organisms associated with more chronic infections such as *Bartonella* species and atypical mycobacteria are known to be associated with fistula or sinus formation. These were not routinely tested for or addressed in our clinical documentation, but require a different approach if suspected. While not a limitation we would like to note that our cohort has a very large proportion of cases where CT was the imaging modality utilized. There are several reasons for this including the rare use of needle aspiration by our clinicians for suppurative adenitis and the long timeframe of the study over which time imaging preferences and capabilities have changed. Our data should not be interpreted as a recommendation to use CT as the predominant imaging modality. In our institution ultrasound has now become the modality of choice for most cases.

In summary, our study adds to the literature several predictive factors for DSA, which clinicians can use including absence of clinical pharyngitis, an elevated peripheral leukocyte count, ≥15,000 cells/mm^3, and

Table 5
Suggested clinical score.

Clinical score (points assigned to clinical variable)	Clinical variable
2	Age younger or equal to 3 years
2	Absence of clinical pharyngitis
1	White cell count ≥15 k/mm^3
1	Prior antibiotic treatment

Table 6
Performance of clinical score.

Clinical score	Percent of patients with drainable abscess[a] (diameter ≥1.5 cm)	Percent of patients with any abscess	Percent of patients that underwent surgical intervention
0	0 (0/6)	0 (0/6)	17% (1/6)[a]
1	3% (1/31)	3% (1/31)	10% (3/31)
2	8% (4/49)	8% (4/49)	22% (11/50)
3	9% (9/98)	12% (12/98)	29% (28/98)
4	23% (9/39)	26% (10/39)	46% (18/39)
5	27% (15/56)	36% (20/56)	50% (28/56)
6	59% (29/49)	69% (34/49)	61% (30/49)

[a] A surgical case where a specimen (culture) was not obtained.

age ≤3 years during decision making for advanced imaging and surgical intervention.

Funding

No conflict of interest, no acknowledgments.

References

[1] Al-Dajani N, Wootton SH. Cervical lymphadenitis, suppurative parotitis, thyroiditis, and infected cysts. Infect Dis Clin North Am 2007;21(2):523–41 [viii].
[2] Carithers HA. Lymphadenopathy. A diagnostic enigma. Am J Dis Child 1978;132(4):353–4.
[3] Niedzielska G, Kotowski M, Niedzielski A, et al. Cervical lymphadenopathy in children—incidence and diagnostic management. Int J Pediatr Otorhinolaryngol 2007;71(1):51–6.
[4] Roberson DF, Kirse DJ. Infectious and inflammatory disorders of the neck. In: Wetmore RF, editor. Pediatric otolaryngology, principles and practice pathoways. New York: Thieme; 2000. p. 969–91.
[5] Leung AK, Robson WL. Childhood cervical lymphadenopathy. J Pediatr Health Care 2004;18(1):3–7.
[6] Fraser IP. Suppurative lymphadenitis. Curr Infect Dis Rep 2009;11(5):383–8.
[7] Serour F, Gorenstein A, Somekh E. Needle aspiration for suppurative cervical lymphadenitis. Clin Pediatr (Phila) 2002;41(7):471–4.
[8] Scobie WG. Acute suppurative adenitis in children: a review of 964 cases. Scott Med J 1969;14(10):352–4.
[9] Robson CD, Hazra R, Barnes PD, et al. Nontuberculous mycobacterial infection of the head and neck in immunocompetent children: CT and MR findings. AJNR Am J Neuroradiol 1999;20(10):1829–35.
[10] Luu TM, Chevalier I, Gauthier M, et al. Acute adenitis in children: clinical course and factors predictive of surgical drainage. J Paediatr Child Health 2005;41(5–6):273–7.
[11] Gosche JR, Vick L. Acute, subacute, and chronic cervical lymphadenitis in children. Semin Pediatr Surg 2006;15(2):99–106.
[12] Baek MY, Park KH, We JH, et al. Needle aspiration as therapeutic management for suppurative cervical lymphadenitis in children. Korean J Pediatr 2010;53(8):801–4.
[13] Wetmore RF, Mahboubi S, Soyupak SK. Computed tomography in the evaluation of pediatric neck infections. Otolaryngol Head Neck Surg 1998;119(6):624–7.
[14] Smyth MD, Narayan P, Tubbs RS, et al. Cumulative diagnostic radiation exposure in children with ventriculoperitoneal shunts: a review. Childs Nerv Syst 2008;24(4):493–7.
[15] Mazonakis M, Tzedakis A, Damilakis J, et al. Thyroid dose from common head and neck CT examinations in children: is there an excess risk for thyroid cancer induction? Eur Radiol 2007;17(5):1352–7.
[16] Friedl JEF. Mastering regular expressions. Sebastapol, Calif.: O'Reilly; 2006
[17] Kimia AA, Savova G, Landschaft A, et al. An introduction to natural language processing: how you can get more from those electronic notes you are generating. Pediatr Emerg Care 2015;31(7):536–41.
[18] Tanir G, Tonbul A, Tuygun N, et al. Soft tissue infections in children: a retrospective analysis of 242 hospitalized patients. Jpn J Infect Dis 2006;59(4):258–60.
[19] Papadopouli E, Michailidi E, Papadopoulou E, et al. Cervical lymphadenopathy in childhood epidemiology and management. Pediatr Hematol Oncol 2009;26(6):454–60.
[20] Watkins CHH, Havens FZ. Lymphadenopathy of the neck. Am J Surg 1942;LVI(1):308–13.
[21] Hawkins DB, Austin JR. Abscesses of the neck in infants and young children. A review of 112 cases. Ann Otol Rhinol Laryngol 1991;100(5 Pt 1):361–5.
[22] Collins B, Stoner JA, Digoy GP. Benefits of ultrasound vs. computed tomography in the diagnosis of pediatric lateral neck abscesses. Int J Pediatr Otorhinolaryngol 2014;78(3):423–6.
[23] Kirse DJ, Roberson DW. Surgical management of retropharyngeal space infections in children. Laryngoscope 2001;111(8):1413–22.
[24] Fellner A, Marom T, Muallem-Kalmovich L, et al. Pediatric neck abscesses: no increase in methicillin-resistant *Staphylococcus aureus*. Int J Pediatr Otorhinolaryngol 2017;101:112–6.
[25] Worley ML, Seif JM, Whigham AS, et al. Suppurative cervical lymphadenitis in infancy: microbiology and sociology. Clin Pediatr (Phila) 2015;54(7):629–34.