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Association Between Computed Tomographic Scan and Timing and Treatment of Peritonsillar Abscess in Children

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IMPORTANCE There is not a consensus on the best diagnostic algorithm for children with a potential peritonsillar abscess. The association of computed tomographic (CT) scanning in children with a pertonsillar abscess and intervention chosen by the treating physician, or the potential delay of treatment associated with such imaging, has not yet been explored.

OBJECTIVES To determine if use of a CT scan is associated with a difference in clinical intervention for peritonsillar abscess and to determine if use of a CT scan is associated with delay of this intervention.

DESIGN, SETTING, AND PARTICIPANTS A retrospective case-control study examined therapeutic interventions, based on the presence or absence of a diagnostic CT scan, in children diagnosed with peritonsillar abscess from November 1, 2006, to November 1, 2015. Children who presented either to the emergency department or to their pediatrician with a peritonsillar abscess were divided into 2 groups: those diagnosed without the use of a CT scan (controls; n = 38) and those diagnosed with the use of a CT scan (cases; n = 30).

MAIN OUTCOMES AND MEASURES Patients were examined for 2 outcomes: admission or no admission. The groups were also examined for type of intervention performed: bedside procedure (needle aspiration or incision and drainage), surgical procedure in the operating room (needle aspiration, incision and drainage, or tonsillectomy), no procedure, or both bedside and surgical procedure. In addition, the time to an otolaryngology consultation and to each of the above interventions was calculated.

RESULTS Thirty children underwent a CT scan, while 38 did not. The mean age of children who underwent a CT scan was 14.3 years (range, 3-18 years) and 11.3 years (range, 1-18 years) for those who did not, for an absolute difference of 3 years (95% CI, 0.38-5.62). Among 68 patients (27 boys and 41 girls), there was no significant association between CT scan and admission or between CT scan and type of procedural intervention. However, there was a clinically significant association between CT scan and time to intervention. Mean time to an otolaryngology consultation was 369 minutes in the CT scan group and 63.4 minutes in the control group for an absolute difference of 305.6 minutes (95% CI, 208-404). Mean time to admission was 340 minutes in the CT scan group vs 166 minutes in the control group for an absolute difference of 174 minutes (95% CI, 65.3-283). Mean time to bedside procedure was 493 minutes in the CT scan group compared with 175 minutes in the control group for an absolute difference of 368 minutes (95% CI, 130-606). No significant association was found between use of CT scan and mean time to surgical intervention: mean time to surgical intervention in the CT scan group and the control group was 1.71 days and 1.64 days, respectively, for an absolute difference of 0.06 days (95% CI, −1.54 to 1.66).

CONCLUSIONS AND RELEVANCE Use of a CT scan is not associated with a difference in intervention in children with peritonsillar abscesses. It is, however, associated with a clinically significant delay in treatment; namely, time to an otolaryngology consultation, time to admission, and time to bedside procedure.

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Peritonsillar abscesses are fairly common in children, occurring in approximately 30 patients per 100 000 per year, comprising 30% of head and neck abscesses, and costing $150 million per year.[1,2] To our knowledge, there is not yet a consensus on the best diagnostic algorithm for children with a potential peritonsillar abscess. The goals of diagnosis and management would include efficiency of diagnosis and treatment, effective intervention, and minimization of adverse effects, including those that may occur as a consequence of early exposure to radiation.

To our knowledge, little has been written regarding the value of computed tomographic (CT) scanning as it relates to the management of peritonsillar abscesses. Several studies explore the diagnostic accuracy of CT imaging as it relates to peritonsillar abscesses, with somewhat variable results and a relatively small number of patients.[3,4] No studies, to our knowledge, have explored the association of CT scanning and intervention chosen by the treating physician or the potential delay of treatment associated with such imaging. We present a retrospective case-control study in which therapeutic interventions were examined in children with a diagnosis of peritonsillar abscess, diagnosed either with or without the aid of a CT scan. Our study sought to examine whether the presence or absence of a CT scan is associated with the ultimate interventions for peritonsillar abscess in children and whether use of a CT scan is associated with a delay of those interventions.

Key Points

Question Is performing a computed tomographic (CT) scan associated with a difference in timing of clinical intervention in children with peritonsillar abscess?

Findings This case-control study found no association between use of a CT scan and clinical intervention performed but did find an association between CT scan and delay to admission, otolaryngology consultation, and bedside procedure.

Meaning Use of a CT scan may not change the intervention in children with peritonsillar abscess but may cause a delay in care.

Methods

The study design was approved by the Ochsner Medical Center institutional review board, and waiver of patient consent was granted. Patients with a diagnosis of peritonsillar abscess were identified by data mining electronic medical records and were then divided into 2 groups based on the presence or absence of a diagnostic CT scan. Exclusion criteria included age older than 18 years, absence of true peritonsillar abscess (eg, patients with tonsillitis or deep neck space infection), or insufficient records to accurately establish the timing of events (ie, some archived paper records that had been incorporated into the electronic medical record via document scan.) The records were obtained from a single institution with several satellite campuses. The data on these 68 children comprise information sufficient to draw clinically meaningful conclusions given that most publications on this subject thus far have less than 50 patients.

Children initially presented either to the emergency department or to their pediatrician's office from November 1, 2006, to November 1, 2015. The medical records were then surveyed for various categorical outcomes. First examined was admission vs no admission. The second categorical outcome examined was the type of intervention. The interventions were classified into 4 categories: bedside procedure (needle aspiration or incision and drainage), surgical procedure in the operating room (incision and drainage or quinsy tonsillectomy), no procedure, or both bedside and surgical procedures. *Surgical procedure* was defined as a surgical intervention during the same admission in which peritonsillar abscess was diagnosed (ie, quinsy tonsillectomy) and did not include delayed tonsillectomy.

In addition, continuous variables were evaluated; these included time to otolaryngology consultation and time to each of the above interventions (admission, bedside procedure, and surgical procedure). Categorical and continuous variables were analyzed using χ^2 and Wilcoxon rank sum tests, respectively. Effect size was determined by calculating 95% CIs for the absolute difference in proportion of categorical variables and for the absolute difference of the means for continuous variables.

Results

Thirty children underwent a CT scan, while 38 did not. The mean age of the children who underwent a CT scan was 14.3 years (range, 3-18 years) and of those who did not was 11.3 years (range, 1-18 years) for an absolute difference of 3 years (95% CI, 0.38-5.62) (**Table**). The proportion of boys who underwent a CT scan was 0.370, whereas the proportion of girls who underwent a CT scan was 0.488 for an absolute difference of 0.118 (95% CI, -0.119 to 0.331). Twenty children who underwent CT scan (67%) and 24 who did not undergo CT scan (63%) were admitted to the hospital, while 10 (33%) and 14 (37%), respectively, were not hospitalized. Of the children who underwent a CT scan, 10 (33%) were treated with a bedside procedure compared with 14 children (37%) who did not undergo a

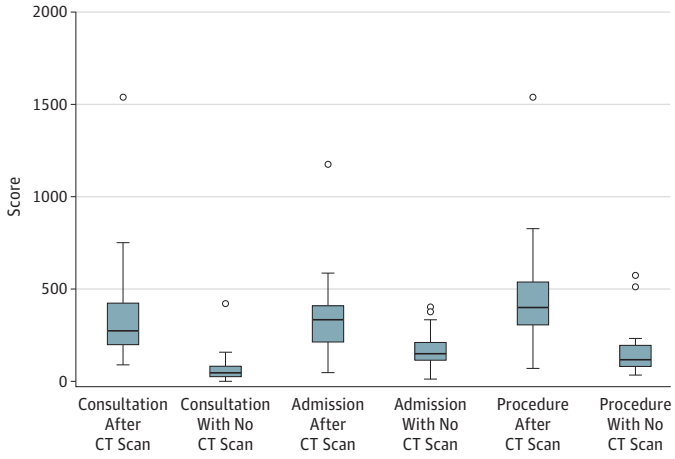
Table. Patient Characteristics

Characteristic	CT Scan	No CT Scan	Absolute Difference (95% CI)
Age, y, mean (range)[a]	14.3 (3-18)	11.3 (1-18)	3 (0.38-5.62)
Male sex, No. (proportion)	10/27 (0.370)	17/27 (0.630)	NA
Female sex, No. (proportion)	20/41 (0.488)	21/41 (0.512)	NA
Absolute difference between male and female sex, proportion (95% CI)	0.118 (-0.119 to 0.331)	NA	NA

Abbreviations: CT, computed tomographic; NA, not applicable.

[a] Younger children were more likely to not undergo CT scan; effect size is demonstrated by absolute difference.

Figure. Time to Otolaryngology Consultation, Admission, and Bedside Procedure



Wilcoxon rank sum scores for time to consultation, time to admission, and time to bedside procedure as measured by the time of initial presentation ($P < .05$ for all values). The time range to consultation for the computed tomographic (CT) scan group was 1:29-25:40 (hr:min) and for the control group was 0:10-6:59. The time range to admission for the CT scan group was 0:45-19:33 and for the control group was 0:11-6:41. The time range to bedside procedure for the CT scan group was 1:08-25:40 and for the control group was 0:32-9:32. The horizontal line in the middle of each box represents the median. The circles indicate the outliers (in this case, the largest values for time) for each respective category. The horizontal lines surrounding the box plots represent 1.5 × interquartile range.

CT scan. In the CT scan group, 7 children (23%) underwent a surgical procedure compared with 12 (32%) in the group that did not undergo a CT scan. One patient in each group underwent a bedside procedure followed by a surgical procedure during the same hospital admission, and 12 patients (40%) in the CT scan group had neither bedside nor surgical intervention compared with 11 patients (29%) in the group that did not undergo a CT scan ($P = .77$). Based on results of χ^2 analysis, there was no significant association between the presence of a diagnostic CT scan and admission or between the presence of a diagnostic CT scan and type of procedural intervention (bedside, surgical, both, or none).

Clinical significance was achieved when analyzing the time to intervention using the Wilcoxon rank sum test. Mean time to otolaryngology consultation was 369 minutes in the CT scan group and 63.4 minutes in the control group for an absolute difference of 305.6 minutes (95% CI, 208-404). Mean time to admission was 340 minutes in those who underwent a CT scan compared with 166 minutes in those who did not for an absolute difference of 174 minutes (95% CI, 65.3-283). Mean time to bedside procedure was 493 minutes in the CT scan group compared with 175 minutes in the control group for an absolute difference of 368 minutes (95% CI, 130-606). No significant association was found between use of a CT scan and mean time to surgical intervention. The mean time to surgical intervention in the CT scan group and the control group was 1.71 days and 1.64 days, respectively, for an absolute difference of 0.06 days (95% CI, -1.54 to 1.66) (**Figure**).

Discussion

Our study found that use of a CT scan did not have an association with admission or type of procedural intervention. It is, however, associated with increased time to admission, time to otolaryngology consultation, and nonsurgical intervention. Two decades ago, routine use of CT scanning during the workup of a peritonsillar abscess was not the standard of care. Published work dating to the 1990s acknowledged use of CT scanning as a mainstay for deep neck space infections but called its use in diagnosis of peritonsillar infections a novel development.[5-8] During the past several decades, reliance on CT scanning has become much more common, even routine, in the emergency department or in the pediatric primary care clinic before otolaryngology consultation. There has not necessarily been definitive evidence to support this trend, however.

In fact, multiple studies emphasize that the traditional criterion standard—clinical evaluation—remains the cornerstone of diagnosis and management of these patients.[9] In a study of 102 pediatric patients, Blotter et al[10] found that, of those who presented with the typical symptoms of peritonsillar abscess (including odynophagia, dysphagia, trismus, drooling, malaise, tonsillar bulge, and inability to eat or drink), the inability to tolerate oral intake after 24 hours was the most significant predictor of clinical outcome. Computed tomographic scanning was used in only a small percentage of the study population, but in that group, it was not found to be helpful in predicting the need for surgery. With a sensitivity of 100% and a specificity of only 50% for the diagnosis of peritonsillar abscess, the conclusion was that CT scanning was not useful in routine management in light of the overshadowing importance of clinical assessment and tracking of clinical progress. More recently, Kim et al[11] evaluated further clinical features that predict successful response to nonsurgical treatment, including younger age, fewer episodes of tonsillitis, and smaller abscess size.

Conversely, a 1992 study by Patel et al[3] found that, in 24 patients examined for peritonsillar abscess, CT scanning enhanced diagnostic accuracy. Three years later, a case report of

a single patient was published in which the authors found CT scanning helpful for distinguishing peritonsillar cellulitis from abscess.[4] Others propose ultrasonography as superior to both CT scanning and clinical diagnosis, with 1 study citing an ultrasound specificity of 100% in the 14 patients examined.[12]

In deep neck space infections, including the nearby parapharyngeal space, the usefulness of CT scanning is more widely accepted, although it has been established that imaging has limitations and clinical evaluation is an essential part of the diagnostic process and of the decision to perform surgery.[5,6,13,14] Similar to the findings in patients with peritonsillar abscess, clinical status and lack of response to intravenous antibiotic therapy will effectively guide the decision to perform surgery for drainage of a deep neck abscess.

In addition, one must consider the harms of radiation exposure. In children who undergo CT scanning of the head or neck, there is a modest increased risk of malignant neoplasms. It is estimated that 1 excess brain malignant neoplasm occurs for every 4000 brain CT scans performed in children. Facial CT scanning carries a statistically significant increased risk of all combined malignant neoplasms, with an incidence rate ratio of 1.14; neck or spine CT scanning carry an incidence rate ratio of 1.13 as well.[15] More immediate concerns are present: it is estimated that up to 13% of pediatric patients aged 3 to 5 years require anesthesia for CT imaging, which can be concerning for the clinician.[16] Variable risks exist according to the anesthetic agent, including oversedation, hypoxemia, upper airway obstruction, aspiration, and respiratory arrest.[17]

Our data support the findings in the literature that indicate that CT scanning is not a good indicator of the need for intervention in children with peritonsillar abscesses.[9-11] The study groups underwent admission and/or intervention at nearly the same rate regardless of whether they underwent imaging, indicating that use of a CT scan does not correlate with the need for admission or the need for procedural intervention. Furthermore, the children who underwent CT scanning experienced a delay in their treatment as measured by the time from presentation to otolaryngology consultation, the time from presentation to admission, and the time from presentation to bedside procedure.

Some limitations to our study exist. An in-depth look at individual cases of peritonsillar abscess in, perhaps, a prospective setting may provide further information as to how imaging directly guided treatment decisions. However, in a retrospective medical record review, this information was not always readily available, which was the case for 1 patient for whom the otolaryngology consultation was not performed until 3 days after admission. Further examination of the record showed that the patient had already been discharged from the hospital after a 1-night stay with supportive care and intravenous antibiotics. She then followed up for establishment of care rather than consultation for an ongoing problem. In this case, the CT scan was not associated with the timing of the consultation. Another consideration is that it is possible that cases in which imaging was pursued were intrinsically more complex and would have had a longer hospital course regardless. Despite this limitation, at the cohort level, CT scanning was not associated with a change in treatment. Our interpretation is that this study's data adds valuable clinical information in that, even with a possible difference in clinical complexity between the 2 groups, no significant difference was found in the types of interventions performed. Stated differently, both groups will ultimately arrive at the same end point and require the same interventions, although the interventions may occur on different time lines. This finding highlights the need for a diagnostic algorithm that can be followed for all patients such that delays are minimized by eliminating unnecessary imaging.

We postulate that time to surgical intervention was not correlated with clinically meaningful delay because it is our institution's practice, as described in the literature, to allow clinical progress to dictate the need for surgery. The difference in age between the 2 groups is not unexpected considering that younger children are, in general, less cooperative and that physicians tend to be more mindful of the possibility of excess radiation exposure over time in young patients. Similarly, the necessity of sedation to obtain accurate imaging results in younger children should also be considered as a deterrent for obtaining unwarranted imaging. This mindfulness should be exercised for all pediatric cases of peritonsillar abscess.

Conclusions

The utility of CT scanning in the diagnosis and management of peritonsillar infections has yet to be proved. In fact, we do not necessarily find CT scanning to be helpful in the initial management of such children. In light of the potentially harmful effects of radiation and the prospective need for sedation in this population, care needs to be taken when choosing the correct patient to undergo CT scanning. According to the literature, patients who do not require surgical intervention will generally improve within 24 hours of institution of supportive care and intravenous antibiotics.[6,10] Therefore, it is our institution's practice to pursue CT scanning only after supportive care measures or attempted intervention have failed. We hope to see further research in this area to aid in defining an evidence-based diagnostic algorithm that can be applied wherever the child is first encountered, with the goal of improving quality of care by minimizing delays, reducing risk associated with radiation exposure, and enhancing cost-effective practices.

ARTICLE INFORMATION

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Study concept and design: Both authors.
Acquisition, analysis, or interpretation of data: Both authors.
Drafting of the manuscript: Both authors.
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