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Teaching of the Society for Fetal Urology grading system for pediatric hydronephrosis is improved by e-Learning using Computer Enhanced Visual Learning (CEVL): A multi-institutional trial

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Summary

Introduction
It is unclear how clinicians learn to grade pediatric hydronephrosis (HN) and how effective their training has been. We sought to:

1. Assess how clinicians learn to grade HN and their confidence in their training and abilities and
2. To assess Computer Enhanced Visual Learning (CEVL) e-Learning to learn the Society for Fetal Urology (SFU) grading system for pediatric HN.

Methods and materials
A multi-institutional online survey was distributed to pediatric urologists, nephrologists, and radiologists. Respondents used a 6-point Likert scale (0 = not confident to 5 = very confident) to assess their confidence in knowledge of the criteria, indications, and ability to grade HN, and how they learned to grade. Participants assigned SFU grades to 15 neonatal ultrasounds (US). A CEVL module on the SFU grading system was accessed and a post-CEVL survey completed. Changes in confidence and accuracy of grading were compared before and after CEVL e-Learning.

Results
The most common method of learning was "casually during training" (44.5%). Significant increases in confidence in knowledge of criteria, indications, and ability to grade, as well as the accuracy of grading were seen following CEVL e-Learning (Figure A and B).

Discussion
Although the SFU grading system is considered the predominant grading system for HN, its application in clinical practice has been inconsistent. While this may be due to the grading system itself, it is possible that deficient training and confidence are the root causes. Our data supports this by demonstrating that most clinicians receive only casual training and accordingly, report low confidence in their knowledge and ability to grade HN. Therefore, we conclude that there exists a strong need to improve the teaching of the SFU grading system.

e-Learning has been shown to be effective in teaching difficult topics and skills. We demonstrate that e-Learning with CEVL is effective in increasing both the confidence and accuracy of SFU grading of pediatric HN.

Limitations of our study include a small sample size, low response rate, and discrepant participation. Furthermore, we did not assess the extent to which the CEVL module was used or include a control group learning through traditional means. Therefore, we were unable to evaluate the efficiency of learning or be certain that the improvements seen were derived exclusively from CEVL.

Conclusion
Current training in SFU grading of HN is mostly unstructured and inaccurate grading is common. Learners who use CEVL show improvements in their confidence and ability to SFU grade HN.

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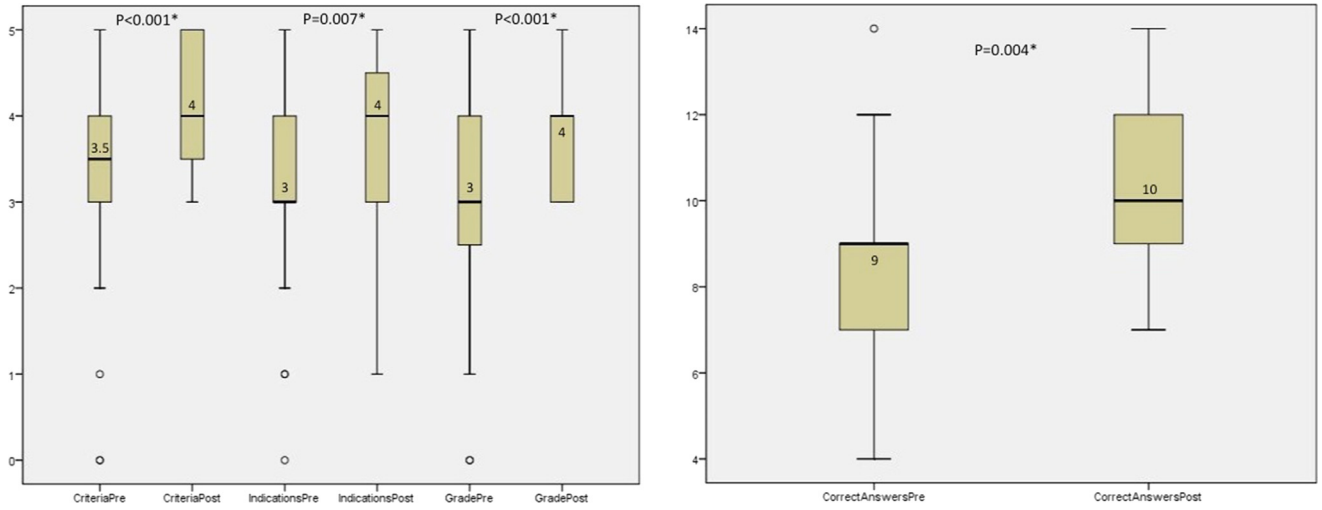

Figure Confidence (A) and accuracy of grading (B) before and after CEVL e-Learning. [a] Confidences are expressed on a 6-point Likert scale (0 = no confidence to 5 = very confident) [b] Number of correctly graded US are out of 1***5***. * p-value <0.05 denotes statistical significance. CEVL-Computer enhanced visual learning.

Introduction

Antenatal hydronephrosis (HN) affects up to 4.5% of all pregnancies [1—4]. However, up to 88% of affected fetuses will ultimately not require urologic intervention [5]. Predictors of the need for urologic intervention are predicated on the grade of the initial postnatal ultrasound (US). In an effort to standardize grading, the Society for Fetal Urology (SFU) introduced a 5-point grading system (0—4) based upon the extent of caliceal dilatation and the thickness of the parenchyma overlying the calices [6,7].

Since its introduction, the SFU system has become the most widely used method to grade pediatric HN [8—13]. The ability to accurately grade HN is an essential skill for pediatric urologists (PU), nephrologists (PN), and radiologists (PR). However, we believe that many misconceptions regarding the grading system exist, which decrease the ability to accurately grade HN and in turn, reduce the utility of the system. Research on practices to learn SFU grading may ultimately lead to improvements in the accuracy of this skill. It is currently unclear how the training of clinicians has been accomplished and how effective this training has been.

Computer Enhanced Visual Learning (CEVL) was created as web-based educational tool to deliver content in an easily accessible, interactive format. The CEVL platform was first shown effective for teaching surgical skills [14—16]. It was then adapted to teach grading of HN and has been shown to be effective for teaching urology residents at a single institution [17].

The primary objective of this study is to examine current methods of learning to grade HN amongst PU, PN, and PR and assess their confidence in their training. Secondly, we aim to assess the effectiveness of CEVL as an e-Learning tool to improve the confidence and ability to SFU grade HN at multiple institutions and amongst PU, PN, and PR.

Methodology

Intake survey

After institutional review board determination of exemption, email invitations to participate in an anonymous, online survey were sent to physician extenders, residents, fellows, and attending physicians in the divisions of PU, PN, and PR at 6 institutions (listed in Table 1) as well as to members of the SFU, with a follow up email sent 2—4 weeks after the initial invitation. Participants were queried on how they learned the SFU grading system and asked to assess their confidence in their knowledge of the criteria to grade, indications to grade, and their ability to grade pediatric HN according to a 6-point Likert scale (where 0 = not confident and 5 = very confident). Respondents were then asked to assign SFU grades to 15 representative newborn US images that had been selected and graded by consensus of the authors. None of the participants had previous access to the CEVL module.

CEVL module on SFU grading of hydronephrosis

After completion of the intake survey, participants were directed to an educational module developed using the CEVL platform on how to SFU grade HN as previously described (17). Briefly, an online tutorial was developed at our institution in collaboration with co-authors from two other institutions to present the key concepts and skills of SFU grading, including background knowledge, relevant anatomy, criteria to grade, and indications for SFU grading in accordance with the original description of the grading system [6,7]. Improvements to the module's layout were made to enhance user interactivity. Specifically, sections providing self-assessment and immediate feedback including explanatory texts and graphic overlays were built (Fig. 1a—c). The CEVL module was also made accessible *via*