



Research article

Diagnostic agreement when comparing still and video imaging for the medical evaluation of child sexual abuse



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ABSTRACT

Still photo imaging is often used in medical evaluations of child sexual abuse (CSA) but video imaging may be superior. We aimed to compare still images to videos with respect to diagnostic agreement regarding hymenal deep notches and transections in post-pubertal females. Additionally, we evaluated the role of experience and expertise on agreement. We hypothesized that videos would result in improved diagnostic agreement of multiple evaluators as compared to still photos. This was a prospective quasi-experimental study using imaging modality as the quasi-independent variable. The dependent variable was diagnostic agreement of participants regarding presence/absence of findings indicating penetrative trauma on non-acute post-pubertal genital exams. Participants were medical personnel who regularly perform CSA exams. Diagnostic agreement was evaluated utilizing a retrospective selection of videos and still photos obtained directly from the videos. Videos and still photos were embedded into an on-line survey as sixteen cases. One-hundred sixteen participants completed the study. Participant diagnosis was more likely to agree with study center diagnosis when using video ($p < 0.01$). Use of video resulted in statistically significant changes in diagnosis in four of eight cases. In two cases, the diagnosis of the majority of participants changed from no hymenal transection to transection present. No difference in agreement was found based on experience or expertise. Use of video vs. still images resulted in increased agreement with original examiner and changes in diagnostic impressions in review of CSA exams. Further study is warranted, as video imaging may have significant impacts on diagnosis.

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Introduction

It is estimated that over 25% of females are victims of child sexual abuse (CSA) by the time they reach age 17 (Finkelhor, Shattuck, Turner, & Hamby, 2014). Many of these children are brought to medical care for forensic medical evaluations. When present, forensic evidence of sexual abuse may further substantiate the child's disclosure and serve to protect the child and other potential victims. Conversely, inappropriate classification of an anogenital finding as evidence of sexual abuse may result in confusion for the child, family, and in legal proceedings and, potentially, incarceration of an innocent individual. Thus, it is critical to accurately diagnose anogenital findings that are of possible forensic significance in cases of alleged CSA.

Recommendations for the medical evaluation of possible CSA include photo-documentation of all anogenital exam findings. Photo-documentation allows for peer review, including expert review for provision of a second opinion, and decreases

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the need for repeat examinations (Adams et al., 2007). Frequently, experts in the field of Child Abuse Pediatrics (CAP) are asked to provide oversight or a second opinion, especially in cases with findings suggestive of anogenital trauma. Many experts and review networks currently rely on still images obtained during photo-documentation of anogenital findings in such circumstances (Starling, Frasier, Jarvis, & McDonald, 2013). Conversely, the use of video imaging of anogenital findings in place of still images has also been suggested (Adams et al., 2007).

Still images have been used in multiple previous studies to examine diagnostic accuracy and agreement amongst professionals with varying results (Adams & Wells, 1993; Adams et al., 2012; Brayden, Altemeier, Yeager, & Muram, 1991; Frasier, Thraen, Kaplan, & Goede, 2012; Muram, Arheart, & Jennings, 1999; Paradise, Winter, Finkel, Berenson, & Beiser, 1999; Roberts & Moran, 1995; Sinal et al., 1997; Starling et al., 2013). In general, these studies showed a trend of increased diagnostic agreement with increased levels of provider experience and with clearly normal or abnormal anogenital findings. In many studies, indeterminate or less obvious findings were associated with decreased agreement (Adams & Wells, 1993; Muram et al., 1999; Roberts & Moran, 1995; Starling et al., 2013). To date, studies examining the use of still images have included relatively small numbers of subjects and have not compared videography to still images. Videography enables reviewers to visualize the manipulation and spatial relationships of genital tissues, potentially allowing for improved agreement in the diagnosis of anogenital findings.

In evaluating or reviewing anogenital findings for evidence of previous CSA, one of the most challenging issues, particularly in post-pubertal children, is the classification of a finding as a deep notch or a healed transection (Anderst, Kellogg, & Jung, 2009). A deep notch is a “notch or cleft in the hymen rim, at or below the 3 or 9 o'clock location, which is deeper than a superficial notch and may extend nearly to the base of the hymen, but is not a complete transection” (Adams et al., 2015). In females less than 18 years of age, a deep notch is not considered to be definitive evidence of penetrative genital trauma (Adams et al., 2007, 2015; Adams, 2004). Conversely, a healed hymenal transection, “a defect in the hymen between 4 o'clock and 8 o'clock that extends to the base of the hymen, with no hymenal tissue discernible at that location” (Adams et al., 2015), is a finding that is indicative of healed trauma to the genital tissues (Adams et al., 2007, 2015). Differentiating between deep notches and transections can be difficult, and accurate diagnosis is crucial as the classification of these anogenital findings may have significant forensic, social and legal implications. Comparing provider agreement between videography and still images in the identification of deep notches and transections has been identified as a research priority (Adams et al., 2015). Using imaging from cases of alleged CSA with findings that may be of forensic significance, the primary aim of this study was to compare still imaging to videography with respect to inter-rater diagnostic agreement in post-pubertal females. Our main hypothesis was that video imaging would result in improved inter-rater diagnostic agreement as compared to still photo imaging. Secondly, we aimed to compare inter-rater diagnostic agreement of Child Abuse Pediatricians (CAPs) to non-Child Abuse Pediatricians (non-CAPs), and evaluate the effect of provider experience on agreement.

Methods

This was a prospective quasi-experimental study comparing diagnostic agreement regarding anogenital findings when using still photography vs. videography of exams in cases of alleged CSA. Study participants were medical personnel who frequently performed such exams. The quasi-independent variable was the imaging modality. The dependent variable was inter-rater agreement of study participants with respect to presence/absence of findings diagnostic of penetrative trauma on non-acute, post-pubertal female genital exams. Diagnostic agreement was evaluated utilizing a retrospective selection of video imaging and still images taken directly from video imaging of anogenital exams that were obtained as part of routine care of patients presenting for evaluation at the study center. Diagnostic agreement was determined by comparing participants' diagnosis to that of the original examiner. A “right” answer was not determined using an “expert consensus”; rather, the original examiner's diagnosis was used as a basis for comparison. This method was used for three main reasons: (1) it mirrors the actual peer review or second opinion process, (2) given that the original medical examiner actually manipulated the tissues in question, the original examiner has the best and most information regarding the findings, and (3) the purpose of this study was not to determine a “right” answer, but to evaluate inter-rater agreement.

Videos and Still Images of Genital Findings

Images were obtained from the study center's database which contains 2,950 videos of anogenital exams performed between the dates of November 1, 2010 and June 30, 2014, and the original medical provider's diagnosis regarding anogenital findings. Exams were recorded using the Sony Handycam HD-CX430 or the Panasonic Full HD HC-V750. The primary investigator selected 8 videos that were judged by the original medical provider to clearly depict hymenal complete transections or deep notches in post-pubertal females. Study videos included 3 exams determined by the original medical provider performing the exam to include a deep notch, and 5 exams determined to include a complete transection. Three board certified Child Abuse Pediatricians (study center CAP reviewers) independently and blindly reviewed study videos. All agreed with the original diagnosis of the examining medical provider based on review of the imaging of the exams.

The 8 selected videos were edited using Sony Vegas Movie Studio HD Platinum 10.0 software. Each of the 8 videos was edited from original length into 4 spliced sections, each lasting approximately 5–15 s that best showed the transection or deep notch. Next, the primary investigator used the same editing software to obtain 4 still images directly from each of the 8 edited videos. As such, the still images contained the same images as found in the edited videos used in the study; the only

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