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The forensic rape examination: Is colposcopy really necessary?

The physical examination of sexual assault victims is performed to identify and treat injuries, as well as collect forensic evidence for prosecution. Historically, three primary mechanisms have been used for sexual assault examination: direct visualization, nuclear staining using toluidine blue, and colposcopy [1]. Colposcopic photo-documentation of anogenital injuries as part of the medical-forensic examination of the sexual assault victim has become more widespread nationally; however, few studies have compared its effectiveness among other examination techniques. Research in clinical forensic medicine show that trained examiners using colposcopy obtain evidence of anogenital trauma in 71% to 86% of rape victims [1-3]. Although this is a significant improvement over protocols relying on gross visualization [3] or toluidine blue dye enhancement [4], drawbacks to colposcopy include the expense and maintenance of equipment, additional provider training, and the psychological trauma to the patient of a genital examination under magnification. The purpose of this study was to compare visualization of anogenital injuries in sexual assault victims among these three prominent forensic examination techniques.

This prospective controlled trial was set in a community-based nurse examiner program (NEP) over a 24-month study period. The majority of patients came from law enforcement dispatch and crisis line contacts. Those sexual assault victims presenting directly to the four city emergency departments were transferred to the NEP for evaluation after triage and initial assessment. The NEP was staffed by 9 forensic nurses trained to perform medical-legal examinations; each nurse had performed over 200 sexual assault examinations prior to study initiation. Sexual assault victims were eligible for inclusion in the study if they were age 13 years or older and consented to a genital examination. This examination consisted of direct visual inspection, 1% toluidine blue contrast application, followed by colposcopy using a Cooper Surgical Leisegang© colposcope system with 30× magnification. After each technique, nurse examiners documented the types and number of anogenital injuries visualized using a standardized classification system [5]. The study hypothesis was that colposcopy could identify injuries not easily demonstrated using direct visualization or nuclear staining. Data are reported with 95% confidence intervals (CIs).

Four hundred and forty-five consecutive cases of sexual assault met the eligibility criteria and were included in the study. The age range was 13 to 74 years (mean, 24 ± 11 years); 84% were examined within 48 h following sexual assault. Anogenital trauma was detected in 68% (95% CI 64% to 72%) of patients; 27% had single and 41% had multiple sites of trauma. A total of 837 anogenital injuries were documented in the study population (mean number of injuries, 1.9 ± 1.4). The majority (68%) occurred at three specific anatomic sites: posterior fourchette, fossa navicularis, and labia minora. The most common types of injury were lacerations (37%) and abrasions (25%), followed by erythema (23%), ecchymosis (9%) and edema (6%). Direct visualization alone demonstrated 531 (63%; 95% CI 60% to 67%) of anogenital injuries. Nuclear staining with toluidine blue identified an additional 285 lacerations or abrasions (34%; 95% CI 31% to 37%). Colposcopy identified 21 injuries (3%; 95% CI 1% to 4%) not seen using direct visualization or nuclear staining. These injuries were typically localized erythema or edema involving the cervix and hymen. Overall, three women (1%; 95% CI 0% to 1%) had subtle genital injuries detected only by colposcopy.

Colposcopy is a procedure that allows a health practitioner to perform a magnified visual inspection of the internal and external genitalia in the context of a standard gynecologic exam. Teixeira published the first study describing and endorsing the use of colposcopy in the forensic examination of sexual assault victims in 1981 [6]. This landmark study concluded that colposcopy was superior to gross visual inspection in the detection of microtrauma following sexual assault or rape. Subsequent research replicated these early findings, and by 2007, colposcopy with digital imaging had become the standard of care in the sexual assault forensic examination in the United States [7]. Our results call into question this practice. Of the few minor injuries detected by additional use of the colposcope, it is unlikely that this microtrauma had any clinical significance or was relevant for criminal prosecution. An examination of the effect of sexual assault evidence on criminal charge laying showed an odds ratio of 3 for moderate to severe injuries, though minor anogenital injuries were not associated with criminal sexual intent or charge laying [8].

Our results are consistent with Zink et al., who used a similar methodology to compare anogenital injury findings after consensual sexual intercourse [1]. They concluded that direct visualization and colposcopy yielded similar anogenital injury findings. One explanation for these findings may be attributed to the forensic examiner's background. Our sexual assault nurses had extensive experience and training at the NEP with backgrounds in emergency medicine. When compared to direct visualization and nuclear staining, colposcopy seems to offer little advantage to a skilled forensic examiner.

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Electrocardiogram interpretation: Emergency medicine residents on the front lines

Electrocardiogram (ECG) interpretation skills represent an important diagnostic tool we impart to new generations of trainees. It is essential to patient care, diagnostic treatment plans and national hospital quality metrics [1,2]. This burden lies heavily on emergency medicine (EM) physicians, thus, ECG interpretation skills are an essential component of EM residency education.

The American College of Cardiology (ACC) and American Heart Association (AHA) have developed curricula regarding ECG competency within cardiology [3]. Although the Accreditation Council for Graduate Medical Education (ACGME) and American Board of Emergency Medicine (ABEM) created twenty-three EM subcompetencies, none of these specifically refer to ECG interpretation requirements [4]. The EM Council of Residency Directors (CORD) includes ECG interpretation as part of its curricular model but without specific metrics [5].

While efforts have been made to improve ECG interpretation training, EM literature provides little guidance regarding the optimization of ECG curricula [6-9]. We sought to profile the current ECG interpretation curricula and clinical practice patterns, specifically the role of the resident as ECG interpreter.

At the time of survey initiation, there were 166 allopathic EM residency programs within the United States. Program directors (PD) were asked to complete a de-identified questionnaire via a secure application called Research Electronic Data Capture (REDCap; Vanderbilt University, TN). REDCap allowed for response tracking and three additional reminder emails were sent. Participants provided program demographics, geographic location as defined by the Society of Academic Emergency Medicine (SAEM) Regions, and additional information regarding their ECG curriculum and primary rapid ECG interpreter. Per ACC and AHA guidelines, rapid ECGs are performed within 10 min of presentation concerning for acute coronary syndrome [10]. Four senior faculty members, two junior faculty members and one second-year EM resident internally validated the survey questions at our academic institution. The study met exempteion criteria per the Institutional Review Board.

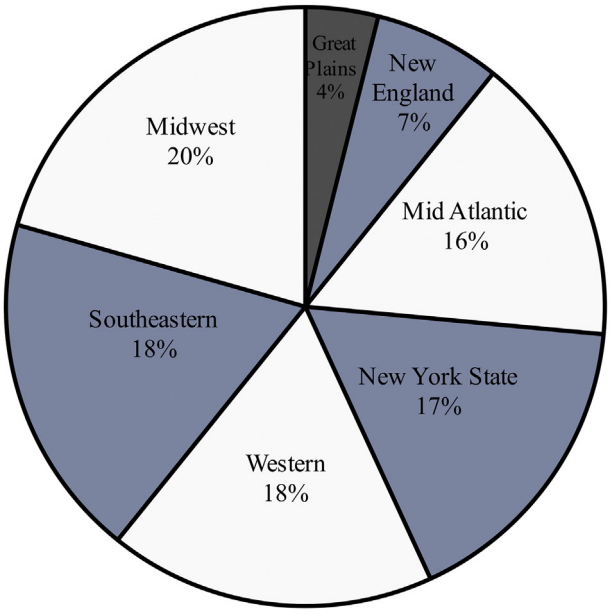

Fig. 1. Geographical distribution of participating emergency medicine residencies as defined by SAEM Regions.

Frequencies and proportions were calculated to determine the most common responses. Fisher's exact tests were performed to assess associations between variables. All analyses were two-sided, with a significant level of ≤0.05. SAS version 9.4 (SAS Institute, Cary, NC) was used for analyses.

Of 166 programs, 102 (61%) participated from various regions of the United States (Fig. 1). Of the responding programs, 71 (70%) are three-year programs and 30 (30%) are four-year programs. Eighty-nine programs (87%) reported an attending as primary ECG interpreter, while only thirteen institutions (13%) allowed the senior resident to perform primary interpretation. Of these thirteen programs, nine (69%) require attending interpretation within 11–30 min and the other four programs (31%) state the attending will review the ECG interpretation at another time during the shift.

Seventy-one programs (70%) provided information regarding required and elective ECG curriculum models (Fig. 2). We found that most programs utilize mandatory didactic lectures, while a smaller portion use innovative teaching modalities such as the flipped classroom model in which learners prepare at home for in-class problem solving [11].

There were important trends in the relationship between [1] geographic location or [2] ECG curriculum and the primary ECG interpreter (Table 1). Midwest programs were more likely to have an attending as primary ECG interpreter (22%, p-value = 0.01). Southeastern and Western programs were more likely to have a resident as primary interpreter (31% for each region, p-value = 0.01). Programs that allowed resident as primary interpreter were more likely to have implemented elective one-on-one training (75% versus 38%, p-value = 0.03).

Our findings expand on previous studies that highlighted ECG curricula as an area for improvement. Over ten years ago, a similar study of EM PDs demonstrated that only half of the residencies queried had a formal ECG curriculum and even fewer had a way to assess competency [12,13]. Since that time, there remains no standardization of the ECG interpretation curricula within EM graduate medical education nor has an optimal teaching method been identified [14].