RESEARCH PAPER

Medical Clearance Prior to Psychiatric Evaluation in a Tertiary Pediatric Emergency Department: Value and Cost Analysis

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Background: Medical clearance in the emergency department for patients undergoing psychiatric evaluation is often required prior to admission to rule out organic cause and because many psychiatric facilities are unable to treat medical conditions. This may be low yield in pediatric populations as the likelihood of disease requiring intervention is low in this setting. Objectives: To determine whether routine laboratory testing in an urban, tertiary pediatric hospital emergency center impacted the overall management of patients presenting with chief complaints requiring psychiatric evaluation, resulting in medical interventions in addition to psychiatric evaluation/treatment. Methods: Retrospective analysis of all psychiatric admissions over a one year period at a large urban tertiary pediatric hospital. Laboratory test results were compared with history and physical notes to determine whether abnormal results could have been anticipated based on patient report. Additional medical interventions required and overall impact on management was recorded. Cost analysis was based on public reimbursement rates, considering tests without impact on intervention to be unnecessary. Results Overall, 1824 tests laboratory tests were performed in 289 patients admitted for psychiatric treatment. There were 161 abnormal results (8.8%), most of which could be anticipated by the medical history. No abnormal result laboratory result led to a change in management for any patient. The sensitivity and negative predictive value for patient-reported drug use compared to urine drug screen results were high, both over 90%. Conclusions Medical clearance in this population is low yield; most abnormal results can be anticipated by patient report or do not require any clinical intervention. The cost of these unnecessary tests was over $500,000.

emergency department | psychiatric evaluation | laboratory testing | cost analysis

Medical clearance of patients who present to the emergency department (ED) with psychiatric complaints is generally required prior to admission to the psychiatric ward. This practice has been used in order to guarantee that the patient can be safely treated in the psychiatric ward, and that no underlying medical comorbidity will require immediate attention. This practice seems intuitive, as the staff of the psychiatric ward may have limited experience and resources for managing acute medical issues and the ward has a much different caregiver to patient ratio (1). The routine use of medical clearance has been controversial, however, in part because the number of patients presenting to the emergency room has increased by 15% over the last decade, increasing the burden on staff (2). Early studies of the utility of medical clearance for adult psychiatric patients in the ED suggested that 63% of psychiatric patients had some underlying organic disease, discovered by this type of testing (3,4). More recent reports indicate that between 4 and 12% of cases' management were actually changed as a result of screening results (5,6), while one study by Korn et al. states that the results of laboratory tests did not change the disposition of any patient included (7); in that study, 34.1% of laboratory results were abnormal, 56.2% of which were positive drug screens. Korn et al reported that only 1.1% of the patients required any medical treatment (due to bacteria detected upon urinalysis, which was treated with antibiotics). Several other studies have also concluded that routine laboratory screening of psychiatric patients in the ED is of little value, and that most abnormalities can be anticipated in the patient's history and physical (2,7-10). with the caveat that the history and physical sec-

Submitted: 04/08/2020, published: 05/05/2020.

tion is often incomplete in psychiatric patients' charts (7,11,12).

While many studies have evaluated the use of medical clearance in the adult ED, very few have addressed whether the same protocol should be standard in the pediatric emergency department. One such study by Fortu et al investigated the results of routine urinary toxicology screening in uncomplicated pediatric patients who presented to the ED with psychiatric complaints (13). The authors reported a high rate of truthfulness of their patients; self-reporting of illicit drug use showed a 92% sensitivity, 91% specificity, and an accuracy of 91%. The authors conclude that the screens were of low yield, and add to the length of stay in the ED as well as the expense of the ED evaluation, offering little additional information (13).

At this time, research suggests that the use of routine-driven, rather than medically-driven, standard laboratory screening of psychiatric patients in the emergency department adds little information to that collected in the patient's history and physical. Additionally, tests whose results are outside of normal ranges do not often require medical intervention, or are expected due to known medical comorbidities. As such, it has been suggested that a screening tool be used to assist in medical clearance of the psychiatric patient, rather than a set of standards tests (14). Further evaluation of this common practice is warranted, particularly in the pediatric emergency department, in which little research has been reported.

Materials and Methods

This project is an observational, retrospective review of patient charts to examine the number of routine laboratory tests performed for patients ages 6-17 years who presented to the Toledo Children's Hospital Emergency Department for medical clearance prior to being admitted to the psychiatric unit over the course of one year. This urban tertiary care hospital is a pediatric level II trauma center and has a dedicated children's emergency room. Toledo Children's Hospital has 151 beds; the emergency department treats approximately 26,000 emergencies annually. The local Institutional Review Board approved this study prior to commencement of data collection, and written consent was waived due to the retrospective nature of the project.

Patient demographics including age, gender, race, comorbidities, psychiatric history, chief and secondary complaints, and medications prior to admission were collected from the electronic medical record. Laboratory results were reviewed to determine whether tests were abnormal, if medical intervention was required due to the abnormalities detected, and whether laboratory findings were explained by the history and physical section of the chart. The following laboratory tests were reviewed as they are routinely performed in the process of medical clearance for psychiatric patients in the emergency department: complete blood count (CBC), including complete metabolic panel, urinalysis, urine drug screen, serum drug screen, alcohol level, thyroid stimulating hormone, and pregnancy test.

Accuracy of the drug screens were compared to patient reported use; patients whose drug use was not documented in the H & P and took no medications were excluded from this analysis (n=133). Positive results that were attributed to a known medication were considered true positives, as were admitted drug use producing a positive screen. Therefore, positive history reflects any documented history or indication that a drug could be present on screening. Negative history required a recorded denies drug use" response in the chart with no prescribed medications. Documented prescribed medications that did not appear on drug screening were not considered false positives as it was possible for low enough doses or infrequent medication use to produce negative screening. Any drug appeared on urine screening that was not a metabolite of a prescribed medication in the history, or not documented as recreationally use, was considered a false negative.

Statistical Analysis

R version 3.3.2 was used for statistical analysis. Descriptive statistics detailed patient characteristics upon study entry. Sensitivity, specificity, positive predictive value, and negative predictive value were calculated for urine and serum drug screens comparing the results of the test to patient-reported illicit drug use and prescribed medications on study entry, including only those with documented response to provider's prompt for self-report of drug use.

Results

During the one year of charts reviewed, 497 encounters of patients presenting for psychiatric evaluation between the ages of 6 and 17 years of age were identified. 208 visits were excluded from analysis as they were not ultimately admitted for evaluation; of these, 3 were discharged from the emergency center to court/jail, 12 were transferred to another hospital, 4 left against medical advice, and 189 were discharged to home/self-care. In total, 289 patient encounters met the criteria for medical clearance prior to admission for psychiatric treatment. The majority of these were female (60.9%) and the vast majority had a documented or self-reported history of treatment for mental health diagnoses (94.8%, Table 1). Depression and suicidal/homicidal ideation were the most common chief complaints amongst those in the cohort. Many subjects had more than one complaint documented and recorded; 370 complaints were recorded in 289 patients. The average length of stay was 3.8 ± 1.7 days.

The number of each of the tests considered to be part of medical clearance for psychiatric patients that were actually performed in the cohort are presented in Table 2. The majority of subjects underwent CBC, CMP, urinalysis, TSH testing and urine drug screening. Fewer patients underwent serum drug screening, alcohol screening, and pregnancy test, but these were still performed in the majority of patients. Eleven CMP and CBC results each were considered abnormal, as they were outside the pre-defined limits, but did not require medical intervention. Urinalysis was considered abnormal in 19% of subjects; of these 51 abnormal tests, 21 could be anticipated per medical history as 3 were considered outside normal limits for glucose (known diabetic patients) and 18 were abnormal in menstruating females. Urinalysis resulted in 2 cultures requiring no intervention and the other 28 abnormal results were outside of clinical limits but required no intervention. Two patients with abnormal TSH results went on to have free T3 and T4 testing, which did not result in medical intervention.

The urine drug screening had the highest proportion of abnormal tests of those performed (26.5%), however none led to a change in intervention during the visit. These abnormal results were compared to the history and physical for documented medications and patient report of recreational drug use. The sensitivity was high at 91% with an acceptable specificity of 69.3%, considering the majority was limited to marijuana use and unlikely to prompt additional medical intervention. Negative predictive value was also quite high, suggesting that this population of patients is forthcoming about recreational drug use and prescribed medications will predict abnormal urine screen results (Table 3). One serum drug screen was positive in the cohort, which correlated to a known attempted acetaminophen overdose. Four patients were positive for alcohol on screening; 2 of these patients had documentation of alcohol use as part of the chief complaint at current visit.

Table 1. Baseline patient characteristics and overall average length of stay and cost related to visit of interest.

All patients[a]		**289**
Age mean ± SD[b]		**13.72 ± 2.75**
Gender[a]		
	Male	113 (39.1%)
	Female	176 (60.9%)
Race[a]		
	Black	31 (10.7%)
	Caucasian	230 (79.6%)
	Hispanic	9 (3.1%%)
	Other	9 (3.1%)
	Unknown	10 (3.7%)
Psychiatric history[a]		**274 (94.8%)**
Psychiatric medication at admission[a]		**211 (73.0%)**
Drug use[a]		
	Admitted	64 (22.1%)
	Denied	92 (31.8%)
	Not documented	133 (46.0%)
Referral source[a]		
	Mental health provider	12 (4.2%)
	Parent/guardian/self	263 (91.0%)
	School	4 (1.4%)
	Law enforcement	6 (2.1%)
	Medical provider	2 (0.7%)
	Caseworker	1 (0.3%)
Complaint[a]		
	ADD/ADHD	5 (2.3%)
	Anxiety	4 (1.9%)
	Bipolar Disorder	7 (3.8%)
	Depression	152 (71.0%)
	Drug or substance abuse	5 (2.3%)
	Eating disorder	2 (0.9%)
	Hallucinations	1 (0.4%)
	Mood disorder, NOS	5 (2.3%)
	Multiple personality disorder	1 (0.4%)
	Oppositional defiant disorder	5 (2.3%)
	Psychosis	4 (1.9%)
	Schizophrenia	1 (0.4%)
	Self-harm	3 (1.4%)
	Sexual abuse	1 (0.4%)
	Substance abuse	5 (2.3%)
	Suicidal or homicidal ideation	165 (77.1%)
	Violent/aggressive behavior	4 (1.9%)
Length of stay[c]		**3.8 ± 1.7**
Average total charges to patient		**$15,585 ± $41,388**
Average laboratory charges to patient		**$2,137 ± $631**

a: number of patients, b: years, c: days.

None of the patients screened had a positive pregnancy test. The ultimate intervention recorded for most of the patients reviewed was a change in current medication dose or addition of a new prescription (70.6%).

None of the abnormal tests required any medical intervention or altered the course of care provided to the patients included in this cohort, suggesting that routine use of a battery of laboratory tests in this cohort may not be justified. The amount \spent" on the total of each test in the cohort is based on the charge recorded in the institutional billing database. The CMS reimbursement rate for each of these tests was assumed for the entire population; amount lost (Table 2) reflects the adjustments between hospital charges and reimbursement. Because all tests were performed without consequence to the patient, all were considered unnecessary. Without performing these tests, the institution would have saved over $564,000 per year and patient charges would decrease by about $2,000 on average (Table 1).

Table 2. Laboratory tests performed during medical clearance for psychiatric chief complaint in cohort.

	Number of patient patient	Abnormal number of patients[b]	Additional interventions[c]	Unnecessary amount spent	CMS reimbursement	Amount lost.
CBC	274 (94.8%)	11 (4.0%)	0	$35,620	$2,896	$32,723
CMP	266 (92.0%)	11 (4.1%)	0	$98,154	$4,519	$93,634
UA	269 (93.1%)	51 (19.0%)	2	$18,690	$1,727	$16,962
TSH	264 (91.3%)	11 (4.2%)	2	$79,910	$4,181	$75,728
UDS	272 (94.1%)	72 (26.5%)	0	$205,632	$24,904	$180,727
Serum drug screen	176 (60.9%)	1 (0.6%)	1	$132,650	$10,640	$122,010
Alcohol screening	175 (60.6%)	4 (2.3%)	0	$28,044	$2,600	$25,443
Pregnancy test[a]	128 (72.7%)	0 (0.0%)	0	$18,304	$1,350	$16,953
Total				**$617,004**	**$52,820**	**$564,183**

a: percent calculation based on total number of females in cohort, b: percent of tests performed, c: includes additional testing completed.

Discussion

The main objective of this study was to evaluate the utility of laboratory testing for the purpose of medical clearance of pediatric patients in the emergency department prior to admission for psychiatric treatment. Of note, a recent consensus statement suggests discontinuation of the term "medical clearance" of these patients in the ED and favors "medical evaluation".(15) At the time of this study, medical clearance was required prior to admission to psychiatry from the ED and was the accepted terminology. Our assessment suggests that the vast majority of patients have a documented history of psychiatric diagnoses prior to presenting to the emergency room (94.8%) and most of these patients are already taking medications associated with these issues. While each of the laboratory tests considered part of medical clearance for this population was not performed in every patient, the cost of the tests (charges to patients) increased their overall charges by over $2000 on average. There were a number of test results that were considered abnormal; about 8% of all tests performed were graded an abnormal result. However, the majority of these abnormal findings were in urine drug screen, which was expected in most cases due to patient prescribed medications or self-reported recreational drug use. No abnormal test resulted in medical intervention or changed the management of the patient.

The rate of abnormal tests in this cohort is somewhat lower than previously reported (7). Abnormal tests required additional medical intervention or a change in clinical management (additional testing) of only 5 (1.7%) patients; one of these was a known acetaminophen overdose on arrival. Donofrio et al found that in a large cohort of pediatric patients, management only changed in 5.7% and disposition was not affected by the test results or the management changes (16). Similarly, previous studies of testing that considered any test outside a normal range, even if it did not result in intervention, have also concluded that routine laboratory screening in order to provide medical clearance for pediatric patients presenting to the emergency department for psychiatric evaluation is of low yield and data do not support its continued use (17-19).

Few studies have evaluated the routine use of this barrage of testing for medical clearance in the emergency department for pediatric patients. However, a few reports have focused specifically on the utility of routine urine drug screening in this population. The results of those studies mirrored the results of adult investigations (8,20-23); surprisingly, pediatric psychiatric patients have been generally honest about drug use when responses are compared to laboratory results (13). As is the case with other routine laboratory tests, the results of urine drug screens are unlikely to impact clinical management of the patient (17,24). There is however a role for toxicology testing in the psychiatric setting in pediatric and adult patients, particularly in cases where suspected overdose is being investigated. It is surprising in the current cohort of patients the proportion that underwent serum drug screening for medical clearance, which is more expensive than a urine drug screen and also provided no results that changed the management of patients, especially given that

only one case was known or suspected acetaminophen overdose.

The process for managing psychiatric patients in the pediatric emergency department is especially important because the number of emergency visits for psychiatric evaluation has continually increased over the past two decades due in part to the limited psychiatric services available for children (25). Research has shown that patients who undergo routine laboratory screening for medical clearance spend significantly longer in the emergency department (16). This can contribute to crowding, and may be associated with risks related to suicidal or aggressive patients. Moreover, the boarding of psychiatric patients could impact the flow of care for medically emergent cases and result in significantly higher costs (26).

Table 3. Results of Urine Toxicity Screening - frequency of abnormal results and proportion indicated by history and physical.

	Abnormal result	Indicated
UTS Substance[a]		
Marijuana	20 (7.4%)	18 (90.0%)
Amphetamine, methamphetamine	34 (12.5%)	32 (94.1%)
Benzodiazepine	23 (8.5%)	19 (82.6%)
Cocaine	1 (0.4%)	1 (100.0%)
Opiates	5 (1.8%)	3 (60.0%)
SDS Substance[a]		
Alcohol	4 (2.3%)	2 (50.0%)
Acetaminophen (high dose)	1 (0.6%)	1 (100.0%)
Sensitivity	61/(61+6)	91.0%
Specificity	70/(70+31)	69.3%
PPV	61/(61/31)	66.3%
NPV	70/(70+6)	92.1%

a: number of patients b: percent of tests performed, c: includes additional testing completed. Sensitivity of medication reconciliation and self-report of drug use where: True Positive = +ve history, +ve UTS; True Negative = -ve history, -ve UTS; False Positive = +ve history, -ve UTS; False Negative = -ve history, +ve UTS, PPV = positive predictive value, NPV = negative predictive value.

In addition to the impact on workflow, the routine practice of conducting the full battery of laboratory tests in these patients has considerable financial implications. In the present study, even when each patient did not undergo every test included in analysis, the relative savings that could have been appreciated if those tests which did not affect medical management were not completed would have been significant to both the patient and the institution. Based on Medicare reimbursement rates for the tests actually performed, we found that patient charges would have been reduced by more than $2,000 on average. While it is very difficult to quantify actual cost to the facility, the cumulative cost of these tests was over $500,000 in the one year reviewed. Donofrio and colleagues conducted additional financial analysis of their data, estimating that based on Healthcare Cost and Utilization Project data, abandoning routine medical clearance for pediatric psychiatric patients could save about $90 million annually (27). The additional impacts on staff time, patient time in the emergency department, and potential impact on patient satisfaction were not investigated, but are potential areas for additional study and consideration when examining practices relating to this patient population.

The current investigation is subject to a number of limitations, particularly those inherent to a retrospective chart review. Due to the retrospective nature, there could have been undocumented reasons for specific testing or suspicion of medical conditions prompting testing which was not appreciable by the study team. In addition, our findings may not be representative of the experience of other institutions as this report includes a single center, which is part of an urban tertiary hospital.

Conclusion

In conclusion, few studies have examined the utility of routine medical clearance for pediatric patients requiring psychiatric evaluation in the emergency department. Those that have reported on the entire process or urine drug screening alone have found little benefit related to these practices. Our data are similar to previous reports; no patient's clinical course was affected by the screening tests completed prior to psychiatric evaluation. In general, abnormal test results could be anticipated by the history and physical, particularly in cases of hematuria due to menstruation or the presence of drugs in the urine when explained by home medications or admitted recreational use. Due to the low yield, our data does not support continued routine laboratory screening of this population.

Conflict of interest

Authors declare no conflict of interest.

Authors' contributions

RER, MB preformed calculations MB and EI review and revised the manuscript. All authors read and approved the final document.

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