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Filling the void: a low-cost, high-yield approach to addressing incidental findings in trauma patients

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ABSTRACT

Background. Incidental findings are prevalent in imaging but often go unreported to patients. Such unreported findings may present the potential for harm as well as medico-legal ramifications.
Methods. A chart review of trauma patients was undertaken over a year. Systems-based changes were made utilizing our electronic medical record system and our staff protocols to improve the disclosure of clinically relevant incidental findings to patients.
Results. During the preintervention period, 674 charts were reviewed. Trauma patients had a rate of incidental findings of 70%, and 36% of patients had clinically relevant incidentals. Rates of follow-up recommendation and disclosure to patients were 22% and 27%, respectively. In the postintervention period, of the 648 charts were reviewed, the rates of a clinically relevant incidental finding were 35%, but the rates of follow-up recommendation and disclosure to patients were 68% and 85%, respectively.
Conclusion. Incidental findings are more prevalent herein than previously reported. With simple changes and minimal resources, clinically relevant and important improvement in reporting incidental findings can be made to mitigate the harm and medico-legal impact of an incidental finding going unreported.

In the past 2 decades, the increased reliance on computed tomographic (CT) imaging in the emergent evaluation of the trauma patient has led to a dramatic increase in incidental findings (IF) not related to the original indication for the study.[1] The incidence of IFs found on emergent imaging range from 15% to 55%.[2-12] While most of these abnormalities do not require an intervention, 15% to 50% are classified as clinically relevant incidental findings (CRIF) requiring follow-up (e.g., suspected malignancy, aortic aneurysm, etc.).[2-12]

There are 3 limitations within current literature regarding CRIFs. First, disclosure of CRIFs to patients is only 10% to 50%.[3-12] Second, published reports have been performed largely from trauma centers serving urban populations, where average patient ages trend younger, and there is a greater ratio of penetrating-to-blunt trauma.[2-12] Third, and most notably, there is a paucity of published literature proposing solutions to minimize the harm and medicolegal impact of CRIFs.[12-14]

Our hospital is a level 2 rural/suburban trauma center with >2,600 annual trauma activations, almost exclusively blunt (>95%), and approximately half of the evaluated patients were elderly (i.e., ≥ 65). This unique geriatric trauma population provides an opportunity to analyze and improve on how CRIFs are detected, reported, and managed.

Materials and Methods

This study was approved by the institutional review board and consisted of preintervention and postintervention arms.

Preintervention

A retrospective chart review was undertaken of all trauma team activations from October 1, 2015, to March 31, 2016. Patient demographics, level of trauma activation, number of CTs, type of CTs, IFs per type of CT, and the clinical relevance of IFs were recorded. Also recorded was whether the radiologist documented the need for follow-up and if this information was documented as disclosed to the patient. Incidental findings were considered to be clinically relevant if they required further work up prior to discharge or if they required follow-up after discharge.[3,7,12] Identified CRIFs were reviewed and confirmed independently by an attending radiologist as requiring follow-up, clinical correlation, or notification of the primary care physician (PCP). The following

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findings were not considered incidental in this elderly population and not included in the data collection/analysis: degenerative skeletal changes (arthritis, spinal degeneration), fatty liver, chronic sinus changes, and microvascular disease/atherosclerosis. CT imaging included was head, facial bones, cervical spine, chest, abdomen/pelvis, thoracic/lumbar spine reconstructions, and CT-angiograms of the head or neck. The data set created was then used to calculate the incidence of IFs based on age, follow-up, and disclosure information.

Intervention

A new system with 2 major changes was instituted using our electronic medical record to streamline the process with goals of ensuring that patients are aware of CRIFs, providing them with written documentation and recommendations, and minimizing impact to existing work flows for front line and nursing staff. The first change involved radiology-driven protocols based on the White Papers of the American College of Radiology (ACR) and the guidelines of the Fleischner Society describing incidental findings.[15-22] Radiologists were asked to report as a clinically relevant finding any incidental finding with the potential for requiring follow-up or need for clinical correlation. If a CRIF was identified, radiologists would provide high and low risk follow up modalities and time intervals for each CRIF. Finally, radiologists would report CRIFs in the impression/summary of their report for easy identification in addition to the body of the dictation.

The second change was to modify the electronic trauma history and physical examination to include a required section for incidental findings. Trauma providers were asked to report CRIFs at the conclusion of the trauma evaluation prior to admission or discharge from the emergency room and then required to document it in a new section of the electronic H&P. When this field was populated in the trauma H&P, it created a follow-up visit order automatically with the PCP. This order was then pulled into the discharge instructions automatically with other required follow-up visits.

Hospital staff were educated on these modifications with particular attention to nursing staff and the modifications to discharge paperwork which are reviewed by nurses with patients prior to discharge. Discharge instructions are also sent to all PCPs which provided a physical copy of required follow-up visits, including CRIFs, to PCPs.

Postintervention

Changes were implemented in August 2016, and identical data were collected from September 1, 2016, to November 30, 2016. We used data from emergency room admissions for the post intervention phase to capture all trauma-related CTs. χ^2 testing of significance for the intervention was performed. We also recorded additional information in the postintervention cohort to further demonstrate the impact of a CRIF. Findings that potentially need follow-up but require clinical correlation with patient risk factors (PCP follow-up only cohort) were delineated from findings that require follow-up regardless of risk factors (follow-up cohort). Radiology studies in the follow-up cohort were assessed for the follow-up recommendations from the imaging. If no radiologist follow-up recommendation was in the report, ACR/Fleischner guidelines for the follow up of CRIFs were used.[15-22] CRIFs that were identified on imaging prior to the trauma were considered known and grouped into the PCP follow-up only cohort. CRIFs in the follow-up cohort that were identified by a radiologist as highly suspicious for malignancy, malignant until proven otherwise, or new metastasis that the patient was not aware of, were tallied separately.

Results

In the preintervention arm, 674 charts were reviewed over 6 months. A total of 2,533 CTs were performed for these patients demonstrating 1,273 IFs or 1.9 ± 2. IFs per patient; mean ± standard deviation. There were a total of 246 patients with 396 CRIFs requiring follow-up. When all patients were considered together, 36% had CRIFs (0.6 ± 0.9 CRIFs per patient). A total of 24% of patients <65

Table 1
Overall patients, CTs, and incidental findings in the preintervention arm stratified by age.

	No. of patients	No. of CTs	Total no. of incidental findings	No. of patients with incidental findings	Mean no. of incidentals per patient	No. of patients with clinically relevant incidentals
Total	674	2,533	1,273	456 (70%)	1.9/patient	246 (36%)
<65	292 (43%)	1,104	304	156 (53%)	1.0/patient	70 (24%)
>65	382 (57%)	1,429	969	300 (79%)	2.5/patient	176 (46%)

Table 2
Categorized clinically relevant incidental findings.

Type of CRIF	No. of incidentals before	% of total incidentals before	No. of incidentals after	% of Total incidentals after
Lung nodules, lesions, masses	90	23%	72	22%
Thyroid nodules, thyromegaly	53	13%	52	16%
Lymphadenopathy (cervical, chest, abdominal)	39	10%	16	5%
Aortic aneurysms (thoracic, abdominal)	31	8%	18	5%
Renal nodules, lesions, masses	25	6%	25	8%
Adrenal nodules, lesions, masses	22	6%	20	6%
Liver nodules, lesions, masses	18	5%	20	6%
Other suspicious masses	18	5%	13	4%
Adnexal cyst, lesions, masses	12	3%	15	5%
Pancreatic lesions, mass, dilation, cyst	12	3%	15	5%
Brain lesions (meningioma, hydrocephalus)	11	3%	13	4%
Bone lesions (destructive, sclerotic)	10	3%	13	4%
Bladder thickening, Mass, hydronephrosis	9	2%	8	2%
Other (breast, soft tissue, misc. facial)	54	14%	49	15%

Table 3
Follow-up imaging, specialists, procedures for CRIFs.

Required F/U modality	No. of patients	Example	Specialist for F/U	No. of Patients	Example
CT thorax	42	Pulmonary nodule	CT surgery	10	Thoracic aneurysm
CT Abdomen/Pelvis	8	Adrenal nodule	ENT	1	Thyroglossal cyst
US thyroid	32	Thyroid nodule	Gastroenterology	11	Biliary dilation
US pelvis	16	Adnexal cyst	General surgery	2	Incarcerated hernia
US retroperitoneal	12	Renal mass	Gynecology	4	Adnexal mass
MRI abdomen	34	Pancreatic cyst	Neurosurgery	3	hydrocephalus
MRI brain	4	Brain mass	Neurovascular	1	Berry aneurysm
MRI spine	5	Sclerotic lesion	Oncology	8	New metastasis
PET CT	8	Pulmonary bodule	Ophthalmology	1	Orbital mass
Other Imaging	10	RUQ/Carotid US	Radiation/Oncology	1	New metastasis
Endoscopy	7	GI mass	Urology	12	Hydronephrosis
Other procedure	7	IR Bx, FNA	Vascular surgery	9	Iliac aneurysm, AAA

AAA, Abdominal Aortic Aneurysm; *ENT*, Otolaryngology; *FNA*, Fine Needle Aspiration; *F/U*, follow-up; *GI*, Gastroenterology; *IR Bx*, Interventional Radiology Biopsy; *PET*, Positron Emission Tomography; *RUQ*, Right Upper Quadrant; *US*, Ultrasound.

years old had CRIFs (0.3 ± 0.6 CRIFs per patient), while 46% of patients >65 years old had CRIFs (0.8 ± 1.0 CRIFs per patient; Table 1). Categories of CRIFs are shown in Table 2. Of the 396 CRIFs, radiologists recommended follow-up for 86 CRIFs (22%). The findings were documented as disclosed to a patient for 105 of CRIFs (27%). Of the 246 patients with CRIFs, only 28 patients (7%) were both informed of all CRIFs and given follow-up instructions for their findings.

In the postintervention arm, 648 charts were reviewed over 3 months. A total of 2,443 CTs were performed demonstrating 1,092 IFs (1.7 ± 1.8 IFs per patient). This cohort was not age-stratified. There was a total of 225 (35%) patients with CRIFs requiring follow-up with 330 CRIFs (0.55 ± 0.9 CRIFs per patient). Our radiologists recommended follow-up for 225 CRIFs (68%). The findings were documented as disclosed to a patient for 281 CRIFs (85%). For the 225 patients, 133 patients (59%) were both notified of all of their CRIFs and given follow-up information for their findings. For all 3 of the categories of radiology follow-up, patient disclosure, and follow up with disclosure of all CRIFs, χ^2 testing of the intervention showed statistical significance ($P < .0001$). These data show significant improvement was made to address incidental findings in our trauma patients.

Additional analysis of these 225 patients was performed to stratify CRIFs that would require follow-up regardless of patient risk factors versus CRIFs that would require follow-up with their PCP for decision-making and risk-stratification. All 225 patients were recommended to follow-up with their PCP. Of these 225 patients, 53 patients required follow-up only with their PCP, because they did not meet ACR/Fleischner guidelines for follow-up without additional clinical risk factors. Examples include pulmonary nodules <4 mm requiring follow-up if the patient is a smoker or thyroid nodules <1.5 cm in patients >35 years of age. Any finding that was identified previously as stable on prior imaging was also recommended for PCP follow up only for clinical decision-making.

Of the 225 patients with CRIFs, 20 patients were found to have a new suspected malignancy (radiology report of strongly suspect malignancy, malignancy until proven otherwise, or consistent with malignancy with no prior existing imaging/documentation of the finding), and 5 patients were found to have new metastasis identified on trauma imaging that were undergoing treatment or had been treated previously for malignancy. This represents approximately 4% of the total 648 trauma patients in the 3-month period of data collection. For our institution which has ≈2,600 trauma activations per year, we estimate that we will find ≈100 patients with a new or worsening diagnosis of cancer incidentally.

The remaining 172 patients had at least one CRIF with either high-risk features on imaging or high-risk patient attributes from the chart during that admission which required follow-up. Examples of these findings include pancreatic cysts not identified previously requiring abdominal MRI or a pulmonary nodule >8 mm. A detailed description of needed follow-up imaging, specialists, and procedures is described in Table 3. Of note, findings that had recommended imaging to follow up were not considered to also need specialist follow-up, though it can be assumed that at least some of these findings will also eventually require specialist evaluation after follow-up imaging occurs.

Discussion

This study was performed to better understand the breadth of CRIFs in an elderly cohort with predominantly blunt trauma as well as to understand and improve our institution's disclosure of CRIFs. We proposed a solution to improve the rate of disclosure and provide accurate follow-up information to patients with CRIFs, and then we demonstrated its effectiveness. Furthermore, we sought to clarify whether patients knew about their CRIFs prior to their trauma, and how many CRIFs represented life-threatening pathology (e.g., malignancy).

We first hypothesized that CRIFs are more frequent in rural/suburban trauma centers, where the predominance of patients treated are elderly and are seen predominantly for blunt trauma.[23] The pre- and postintervention arms confirmed this hypothesis. Previous studies showed an incidence of CRIFs as ≈30% at the highest estimates. We think that this reported incidence was an underestimation with an average incidence of 36% and, when the elderly are considered alone, 46%. An IF was found nearly 2 and a half times as often in the elderly trauma patient. These numbers suggest that the scope of the problem in the current literature is much greater than described previously.

In regards to solutions for IFs, we found only 3 studies attempting to improve disclosure of CRIFs. In an article by Yeh et al, PCPs were notified directly of an IF when available.[12] Sperry et al opted for a dedicated trauma IF coordinator.[13] While these approaches demonstrated significant improvement, they required either a large investment of time from front line providers[12] or capital[13] to ensure patients had the required information to follow-up appropriately. Both methods still require communication from the physician to the patient at the discovery of an incidental finding. Collins et al used a simpler protocol of verbally notifying patients during admission and documenting the conversation, but, while their rates improved (18% preintervention, 32% postintervention), there was still a substantial deficit in disclosure.[14] We suspect that many trauma programs share the problems identified by Collins and lack resources necessary for a comprehensive protocol.

Our postintervention arm represents a potential solution. Rather than creating a new process, we focused on improving identification

of CRIFs through how our radiologists report CRIFs to the trauma team, and on augmenting the conversation between the trauma team and the patient when a CRIF is discovered utilizing existing resources. We demonstrated remarkable improvement in disclosing CRIFs to patients and providing them with accurate follow-up information. Strengths of this methodology are that we were able to implement all of our changes into existing workflows without requiring additional staff or duties of nursing and frontline providers who are already struggling to balance current workloads. By leveraging our informatics team and the existing EMR infrastructure, there was no substantial additional cost. Furthermore, the method described can be implemented in nearly any hospital setting, and its utility is not limited only to a trauma service.

One limitation of our method is that 15% of our patients are still leaving without disclosure of their CRIFs. A substantial portion of these discrepancies were from readings made during the night that are performed by an outsourced radiologist rather than in-house radiologists. These reads were confirmed by in-house staff radiology the next day where addendums may recognize CRIFs that are not communicated and therefore subsequently not reported. A few CRIFs were missed by the trauma team due to human error, and we anticipate this number will decrease with further education and utilization of the system. While not a limitation, a portion of CRIFs not disclosed were in patients who went on to expire or proceed to hospice, where there is no benefit to the patient in discussing the finding. For the CRIFs identified in the study that were not disclosed, under the guidance of the institutional review board and hospital administration, the hospital communicated with each of these patients and informed them that there was a missed clinically relevant radiographic finding.

We considered the absence of direct physician-to-physician communication to be another limitation. If resources were available, an optimal approach would be a phone call and letter to both the patient and the PCPs describing the finding similar to the methods of Yeh and Sperry et al.[12,13] This approach could expedite further workup by facilitating follow-up studies and consultation prior to discharge; this approach, however, was not deemed to be feasible for our institution from the perspective of cost and time. The methodology we have described operates as a fail-safe mechanism in the absence of those resources to ensure the patient and the patient's PCP are notified of a CRIF.

We have shown that the magnitude of CRIFs is far more prevalent than previously described. This study demonstrated a reliable framework for a reproducible system of addressing CRIFs, not only in trauma, but also in all hospital services where CT imaging is performed for specific diagnostic purposes. Our solution is simple, cost effective, and shows that small multidisciplinary systems changes can significantly ameliorate the problem and provide a starting point for providers that have no specific protocols in place. It is clear that further work needs to be done on optimizing a cost-versus-benefit approach.

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