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Case report

Autosomal Dominant Polycystic Kidney Disease, incidental finding with trauma: Case report and review of the literature

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Renal trauma;
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Abstract
Introduction: Pre-existing renal lesions predispose kidneys to effects of otherwise insignificant blunt trauma, and may uncommonly present as an incidental finding in the workup of a suspected renal injury.
Observation: This is a case report of a 28-year-old male diagnosed incidentally with Autosomal Dominant Polycystic Kidney Disease (ADPKD) as part of the workup for suspected kidney injury secondary to assault by a brick. This case study serves as a learning opportunity and future reference in the cases and management of blunt trauma to kidneys with pre-existing lesions and also to raise the index of suspicion for renal abnormalities in future cases of mild blunt abdominal trauma that present with significant injury to the kidney. The study design takes the form of a case report and an overview of the relevant literature by searching the following databases: Pubmed, Google Scholar, Cochrane library and Medline. Search terms included: "Abnormal Kidneys", "Pathologic Kidneys", "Polycystic Kidneys", "Autosomal Dominant Polycystic Kidney Disease", "Trauma", "Blunt Trauma", "Blunt Abdominal trauma", "Blunt Renal Trauma", "Pre-Existing Renal Lesions". The literature search revealed 42 published cases of trauma to pre-existing renal lesions. 8 out of the 42 cases involved trauma to patients with Autosomal Dominant Polycystic Kidney Disease (ADPKD) (19%). Among the 8 cases of ADPKD, 4 cases presented with gross haematuria. Abdominal CT was the diagnostic imaging of choice in all cases and revealed injuries ranging from cyst rupture to AAST Grade IV injury to the kidney. Four out of the 8 cases required nephrectomy, and 3 cases were managed conservative-/non-operatively.

Abbreviations: ADPKD, Autosomal Dominant Polycystic Kidney Disease; UPJ, congenital ureteropelvic junction obstruction; HK, horseshoe kidney; RCC, renal cell carcinoma; MVA, motor vehicle accident; PVA, pedestrian vehicle accident; GH, gross haematuria; AP, abdominal pain; FP, flank pain; S, shock; Lap, laparotomy.

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Conclusion: Patients with abnormal kidneys require counselling regarding increased risk of injury following blunt abdominal trauma.
The decision to transfuse a patient following renal trauma to pre-existing renal lesion possibly requiring a renal transplant, should be done with consideration of the increased risk of antigen sensitization. Patients that present with signs and symptoms out of proportion with the mechanism of trauma should raise the suspicion of undiagnosed pre-existing renal lesions.
In cases of blunt renal trauma with a history suggesting the possibility of a pre-existing lesion, the threshold for requesting CT of the abdomen should be lowered, even in absence of gross haematuria.

Introduction

Traumatic injuries are common in South Africa and result from a variety of causes ranging from interpersonal violence, motor vehicle accidents to sports- and occupational injuries. Renal injury following trauma is a common occurrence (up to 5% of all trauma cases) and usually results from a blunt insult, which is about 9 times more common than penetrating trauma of the kidneys [1,2]. Kidneys are retroperitoneal organs that are generally well protected by fat in the anterior abdominal wall, abdominal viscera, as well as the spine and muscles posteriorly [3]. Blunt renal injuries therefore most commonly present with a history of major trauma followed by flank/abdominal pain and haematuria. A direct correlation between the mechanism and grading of renal injury usually exists [4].

Pre-existing renal lesions, however, predispose kidneys to effects of otherwise insignificant blunt trauma, and may uncommonly present as an incidental finding in the workup of a suspected renal injury. Abnormal kidneys may complicate or alter the course and outcome of blunt trauma to the kidneys, as trivial trauma can potentially lead to serious injury, an uncommon occurrence in normal kidneys [1,5]. Biomechanical research was performed which aims to prove the mechanism responsible for the higher risk of injuries to abnormal kidneys subjected to trivial trauma [3]. Minor blunt trauma that results in significant renal injury should therefore raise suspicion of a pre-existing renal lesion and should encourage further work up.

This is a case report of a patient diagnosed incidentally with Autosomal Dominant Polycystic Kidney Disease (ADPKD) as part of the workup for suspected kidney injury secondary to blunt abdominal trauma.

Literature review

A literature search was done and revealed 42 published cases of trauma to pre-existing renal lesions. Table 1 summarizes the published cases found in the literature review according to; demographics, pre-existing renal lesion, mechanism of injury, presentation, special investigations, and treatment. The table serves as a quick reference of the currently available literature.

In the published cases the most common abnormalities that presented with trauma were horseshoe kidneys (11/42 = 26%), followed by congenital uretero-pelvic junction obstruction (10/42 = 24%). Literature search revealed 8 out of the 42 cases involved trauma to patients with Autosomal Dominant Polycystic Kidney Disease (ADPKD) (19%). The most common presenting complaint involved gross haematuria (21 cases) and abdominal/flank pain (18 cases). CT abdomen was the diagnostic imaging of choice in 34 cases and revealed various grades of injuries and abnormalities. Of the 42 cases, 15 cases required laparotomy and of those, 12 cases required nephrectomy. Ten of the 42 cases could be managed conservatively/non-operatively.

Among the 8 cases of ADPKD, 4 cases presented with gross haematuria. Abdominal CT was the diagnostic imaging of choice in all cases and revealed injuries ranging from cyst rupture to AAST Grade IV injury to the kidney. Four out of the 8 cases required nephrectomy, and 3 cases were managed conservative-/non-operatively.

Objectives

The objective of this case study is to report a case of Autosomal Dominant Polycystic Kidney Disease incidentally found in the investigation of suspected renal injury secondary to blunt abdominal trauma. Although there are many articles published regarding the protocol of management of blunt renal trauma, the management of trauma to an abnormal kidney is still a controversial topic. This case study serves as a learning opportunity and future reference in the cases and management of blunt trauma to kidneys with pre-existing lesions and also to raise the index of suspicion for renal abnormalities in future cases of mild blunt abdominal trauma that present with significant injury to the kidney. A review of the literature and cases to date is also done.

The study design takes the form of a case report and an overview of the relevant literature. The rationale for this format is to supply the reader with a comprehensive background of the topic and to compare the information with international case reports. The case was referred form Citrusdal Hospital (Primary Health Care Facility) and managed and reported at Tygerberg Hospital (Tertiary Health Care Facility). A thorough literature review of the published cases of abnormal kidneys that presented incidentally with trauma was done by searching the following databases: Pubmed, Google Scholar, Cochrane library, and Medline. Studies published in English were reviewed and search terms included: "Abnormal Kidneys", "Pathologic Kidneys", "Polycystic Kidneys", "Autosomal Dominant Polycystic Kidney Disease", "Trauma", "Blunt Trauma", "Blunt Abdominal trauma", "Blunt Renal Trauma", "Pre-Existing Renal Lesions".

Table 1 Summary of cases of trauma to pre-existing renal lesions found in literature.

Author	Age	Sex	Pre-existing renal lesion	Injury mechanism	Presentation	Imaging	Treatment	Injury
De Abib et al. [6]	7	m	Wilms tumour	fall from tree	Flank Mass	CT abdo	lap + nephrectomy	ruptured tumour
De Abib et al. [6]	10	f	Wilms tumour	fall from couch	AP	CT abdo	lap + nephrectomy	perinephric haematoma
De Abib et al. [6]	9	m	Wilms tumour	fall from roller skate	GH	?	lap + nephrectomy	ruptured renal tumour
Li et al. [7]	24	m	UPJ	MVA	GH	CT abdo	JJ stent	ruptured renal pelvis
Ghritlaharey et al. [8]	7	m	UPJ	motorcycle accident	GH	US abdo	lap, delayed Anderson Hynes pyeloplasty	ruptured renal pelvis
Poyraz et al. [9]	17	m	UPJ	football injury	FP	CT abdo	percutaneous nephrostomy+ bed rest	urinoma + pelvic rupture
Tsurukiri et al. [10]	18	m	UPJ	football injury	FP+ GH	CT abdo	JJ stent + delayed pyeloplasty	rupture hydronephrosis
Mali et al. [11]	14	f	UPJ	trivial fall while running	GH	CT abdo	conservative, delayed Anderson Hynes pyeoloplasty	corticomedullary laceration + perirenal haematoma
Shalev et al. [12]	4	m	UPJ	fall from chair	GH	CT abdo	nephrostomy + delayed Anderson Hynes pyelopasty	parenchymal laceration
Shalev et al. [12]	26	m	UPJ	minor flank trauma	GH	IVP	nephrostomy tube + delayed nephrectomy	hydronephrosis
Shalev et al. [12]	31	m	UPJ	minor flank trauma	GH	US + IVP	nephrostomy tube + delayed pyeloplasty	hydronephrosis
Hadi et al. [13]	8	m	UPJ	trivial trauma	AP	CT abdo	lap + Anderson Hynes pyeloplasty	ruptured renal pelvis
Ashebu et al. [14]	19	m	UPJ	kick in abdomen	AP	CT abdo	JJ stent + delayed pyeloplasty	rupture hydronephrosis
Desai et al. [15]	2	f	Rhabdoid tumour of kidney	fall 1.5 m	GH	CT abdo	conservative	perinephric haematoma + laceration
Nunez et al. [16]	55	m	Renal cyst	blunt trauma	GH	CT abdo	selective arterial embolization	cyst rupture
Nunez et al. [16]	43	f	Renal cyst	MVA	?	CT abdo	conservative	retroperitoneal cyst rupture
Pandyan et al. [5]	70	m	Renal cyst	PVA	GH + FP	CT abdo	lap + nephrectomy	laceration + perinephric haematoma
De Abib et al. [6]	12	m	Renal clear cell carcinoma	fall from tree	?	CT abdo	lap + nephrectomy	ruptured tumour
Nunez et al. [16]	33	m	Renal angiomyolipoma	blunt flank trauma	?	CT abdo	conservative	Mass + haemorrhage
Dunlop et al. [17]	9	f	RCC	minor sports injury	?	US	?	?
Nunez et al. [16]	55	m	RCC	falling over	FP+ GH	CT abdo	?	subcapsular haematoma

Table 1 (*Continued*)

Author	Age	Sex	Pre-existing renal lesion	Injury mechanism	Presentation	Imaging	Treatment	Injury
Tarhan et al. [18]	30	m	Hydatid cyst	industrial accident	GH	CT abdo	lap + local povidone iodine + partial cystectomy and marsupialisation	rupture hydatid cyst
Trottier et al. [19]	21	m	HK	MVA	S, AP	CT abdo	covered stent + delayed lap	polar artery avulsion
Dominguez et al. [20]	16	f	HK	MVA	GH	CT abdo	conservative	transected isthmus
Sataa et al. [21]	43	m	HK	MVA	AP	CT abdo	conservative	ruptured renal pole
Molina et al. [22]	25	m	HK	?	AP	?	selective embolization	laceration bilateral renal poles
Samaniego et al. [23]	15	m	HK	low velocity blunt trauma	?	CT abdo	?	renal pole rupture
Agrawal et al. [24]	31	m	HK	assault	AP	CT abdo	lap + nephrectomy	avulsion of isthmus
Gaffney et al. [25]	13	m	HK	running into fence	AP	IVP	blood transfusion + nephrostomy tube	pole + collecting system laceration
Daudia et al. [26]	25	m	HK	kicked in abdomen	AP	US +IVP	lap + repair rupture	lower pole extravasation
Legg et al. [27]	49	m	HK	fall 15 feet	FP+ GH	CT abdo	selective arterial embolization	isthmus laceration + retroperitoneal haematoma
Nunez et al. [16]	39	m	HK	blunt trauma	GH	CT abdo	?	anterior retroperitoneal bleed
Hannay et al. [28]	32	f	HK	MVA	S	CT abdo	lap + nephrectomy	disrupted horseshoe kidney + pelvic haematoma
Wu et al. [29]	9	f	Duplex collecting system	fall against chest drawers	GH	CT abdo	conservative	parenchymal and renal pelvis laceration
Kim et al. [30]	39	f	ADPKD+ stone	shock wave lithotripsy	S	CT abdo	nephrectomy	cyst rupture+ perirenal haematoma
Reay et al. [31]	20	m	ADPKD	fell from horse	GH	CT abdo	selective arterial embolization	renal laceration extending into calyx
Klein et al. [32]	40	m	ADPKD	assault baseball bat	GH	CT abdo	conservative	multiple lesions liver and kidney
Mufarrij et al. [33]	77	m	ADPKD	massage chair	FP	CT abdo	conservative + blood transfusion	subcapsular haematoma with+ cyst ruptures
Leslie et al. [34]	22	m	ADPKD	MVA	AP	CT abdo	lap + bilateral nephrectomy	cyst rupture and bleeding
Nash et al. [35]	58	f	ADPKD	MVA	GH	CT abdo	lap + bilateral nephrectomy	multiple cysts + pelvic free fluid
Wani et al. [36]	56	m	ADPKD	strike rope	FP+ GH	CT abdo	conservative	intracystic rupture
Zaslou et al. [37]	29	m	ADPKD	fall 8 feet	FP	CT abdo	lap + nephrectomy	ruptured cysts

Abbreviations: UPJ = congenital ureteropelvic junction obstruction, HK = horseshoe kidney, RCC = renal cell carcinoma, MVA = motor vehicle accident, PVA = pedestrian vehicle accident, GH = gross haematuria, AP = abdominal pain, FP = flank pain, S = shock, Lap = laparotomy.

Table 2 Blood results.

Electrolytes	At presentation	48 h later	72 h later
Na+	136	139	143
K+	4.6	4.3	4.2
Urea	5.2	4.6	3.7
Creatinine	57	66	70

Case

A 28-year-old male that presented with a 1-day history of pain in the left flank as well as macroscopic haematuria after being assaulted with a brick. He does not have any prior medical or surgical history and was not aware of any family history of renal disease. At the time of presentation his vital signs were normal with a heart rate of 71 beats per minute, blood pressure of 119/70 mmHg, temperature of 36.6 °C, haemoglobin of 12.1 g/dL, white cell count of 5.8, and platelets of 175. Urine dipstix revealed 3+ protein. For blood results see Table 2.

The patient was admitted to hospital for CT of the abdomen and conservative management of blunt renal trauma. CT scanning revealed bilateral polycystic kidneys, liver cysts and a left perinephric haematoma most likely due to a ruptured cyst. The decreased perfusion to the injured kidney could possibly be related to the compression of the haematoma on the enlarged kidney in the limited retroperitoneal space (Fig. 1). The CT is in keeping with the most likely diagnosis of ADPKD with a ruptured cyst due to blunt trauma to the left flank.

The patient was kept in hospital for serial vital measurements and strict bed rest. Macroscopic haematuria cleared up after 5 days in hospital and the patient was discharged.

Follow up: Patient was scheduled for follow up nephrology consult and genetic counselling but unfortunately missed the appointment. He was subsequently located, encouraged to schedule a new appointment date for nephrology consult, and counselled regarding the importance of continuity of care and avoiding further renal trauma.

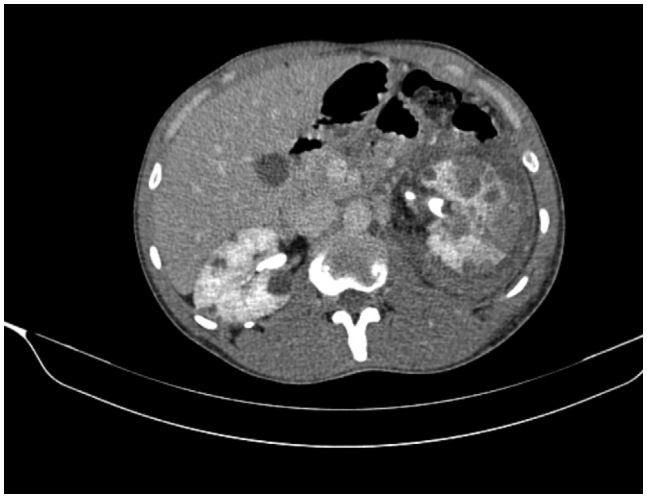

Fig. 1 Coronal CT scan porto-venous phase (Contrast dose: 150 ml of 300 mgl/ml iopromide).

Discussion

Consensus currently exists in the guidelines and protocol in the management of blunt renal trauma (Fig. 2), however, there is limited evidence and no protocol for the management of trauma to pre-existing renal lesions such as the case described above. Increased risk of renal injuries to pre-existing lesions therefore requires special consideration in the diagnosis, approach and management of blunt trauma.

The Consensus on Genitourinary trauma (Fig. 2) suggests that patients with blunt renal trauma that present with microscopic haematuria/no haematuria are managed by observation with no imaging required [38]. Literature search of published cases involving blunt trauma to pre-existing renal lesions reveal that not all cases present with haematuria. This suggests that some cases of undiagnosed pre-existing renal lesions could be missed if strictly managed according to protocol and simply observed. Careful consideration in the workup of blunt renal trauma should therefore be given in cases that have a history suggesting abnormal kidneys. Patients that do however, present with haematuria out of proportion to the degree of trauma should receive a CT abdomen and should be referred to a centre where this radiographic facility is available.

In this case report, ADPKD was incidentally diagnosed after CT abdomen was done in the workup of blunt renal trauma that presented with gross haematuria. Helical CT of the abdomen and pelvis with arterial and venous portal phase including 10 min delayed images are the gold standard diagnostic imaging technique of choice in blunt renal injuries of stable patients. Current protocol suggests doing CT of the abdomen for all stable cases of abdominal trauma presenting with gross haematuria [4]. In centres where CT scanning is not available intra venous urography (IVU) serves as the second line imaging method [38]. Rhyner et al., however, published a study that found CT scanning to be superior to excretory urography in cases of trauma to the abnormal kidney [39]. Specifically with regards to cystic kidneys (such as the case discussed above), CT is superior and accurate in detecting and distinguishing haemorrhage from ruptured cysts due to density differences. CT also reliably detects parenchymal lacerations, vascular injuries, urine extravasation and perirenal haematomas [38]. CT scanning therefore increases diagnostic accuracy and distinction between traumatic injuries and pre-existing renal lesions and will guide the specific course of management approach required [39].

The above case of renal trauma to previously undiagnosed polycystic kidneys was referred to a facility where CT scanning was available and managed conservatively. Guidelines for trauma to kidneys suggest operative management only in the following cases: unstable patients, grade 5 renal injuries and patients with associated injuries requiring exploration-these cases require explorative laparotomy and intraoperative one-shot intra venous urography (IVU). Other relative indications for operative management are also described in: "Consensus of the evaluation and management of renal injuries" by Santucci et al. [38]. In the absence of the above indications, management of blunt renal trauma is conservative with bed rest and serial vital measurements until gross haematuria resolves.

In the case of trauma to a pre-existing renal lesion, there is no consensus regarding operative indications and conservative management. In the published cases involving trauma to patients with ADPKD; presentation, injury severity and treatments varied and is

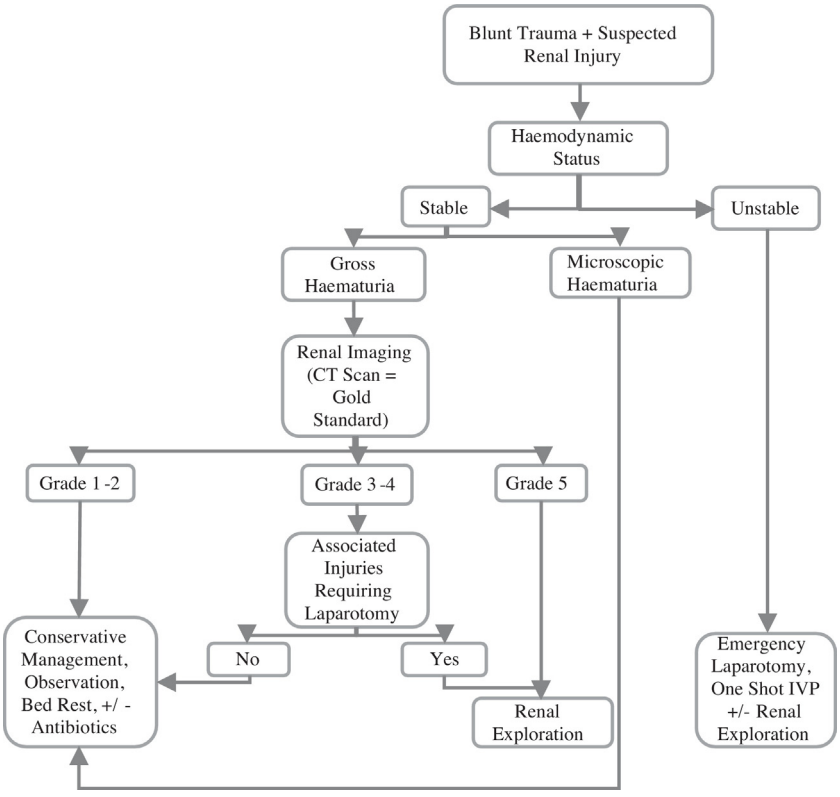

Fig. 2 Flow diagram modified from the European Urological Association (EUA) guidelines on urological trauma [4].

summarized in Table 1. In our case, the diagnosis of ADPKD was incidentally made following rupture of a cyst due to blunt renal trauma and the patient was not aware of any family history of renal disease. The diagnosis of ADPKD, however, is usually made on routine screening of patients with a positive family history of the disease. The common presenting symptoms and sign of ADPKD include flank pain, hypertension, proteinuria, haematuria as well as renal failure [40]. Among the 8 cases of trauma to patients with ADPKD revealed in the literature review above, 4 cases presented with gross haematuria. Abdominal CT was the diagnostic imaging of choice in all cases and revealed injuries ranging from intracystic haemorrhage, cyst rupture to parenchymal (AAST Grade IV) injury to the kidney. In the literature review cystic rupture proved to be the most common injury to polycystic kidneys, followed by intracystic haemorrhage. Five out of the 8 cases of ADPKD showed ruptured cysts on CT imaging.

Cases published in literature reveal treatment based on the underlying abnormality as well as the severity of the injury. Three cases were managed conservative-/non-operatively, and 4 out of the 8 cases required nephrectomy. Reay et al. described a particular case of an AAST Grade IV injury successfully treated by means of selective arterial embolization [31].

The published cases suggest a management hierarchy starting with conservative management with serial vital observations, supportive blood transfusions, followed by radiologic intervention (selective arterial embolization), and operative treatment if conservative and radiologic intervention fails or the patient is unstable. The successful use of desmopressin acetate and aprotinin for the treatment of gross haematuria in a patient with ADPKD has also been described [41].

Patients with ADPKD often require renal transplant at a later stage in life. Careful consideration regarding the benefits and risks of the use of blood products in supportive management is therefore required. It is important to be aware of the possibility of renal transplant complications due to antigenic exposure, antibody formation and sensitization following the use of blood products in the management of cases of trauma to abnormal kidneys (such as the above patient with ADPKD) that could possibly require renal transplant in the future [35].

Table 3 Conclusive learning points.

Learning points:
Patients with abnormal kidneys require counselling regarding increased risk of injury following blunt abdominal trauma.
The decision to transfuse a patient following renal trauma to pre-existing renal lesion possibly requiring a renal transplant, should be done with consideration of the increased risk of antigen sensitization.
Patients that present with signs and symptoms out of proportion with the mechanism of trauma should raise the suspicion of undiagnosed pre-existing renal lesions.
In cases of blunt renal trauma with a history suggesting the possibility of a pre-existing lesion, the threshold for requesting CT of the abdomen should be lowered, even in absence of gross haematuria.

Conclusion

Cases of trauma to pre-existing renal lesions remain a rare occurrence and therefore the management is still a controversial topic that needs further research and experience. Currently the majority of patients are managed according to the underlying abnormality and injuries, such as described in the above case. The important learning and discussion points are summarized in Table 3.

Authors' contributions

NJ Gildenhuys was the main author of this article, and attended to the patient, performed the literature review and wrote most of the manuscript. This was performed as part of a final year assignment for medical studies. Professor A van der Merwe was the attending consultant and initiator of the case report. He was the supervisor and actively involved in guiding the process leading to publication, as well as intellectual input. Professor A van der Merwe was also the head of department and was involved in the management of the patient, obtaining of the photos of the imaging of this patient.

Ethical committee approval

Approval from the Health Research Ethics Committee of the University of Stellenbosch was obtained (Reference number C15/07/003). Clinical data was collected from Tygerberg Academic Hospital patient records. Written informed consent was taken from the patient for the publishing of this case, including photos, in the scientific literature. A literature review was performed utilising both electronic (Pubmed) and printed media.

Conflict of interest

The authors have no conflict of interest.

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