

Improvement of time efficient patient centred care for acute renal colic patients in the Emergency Department

Quality improvement project



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Declaration: I hereby declare that this quality improvement project is my own work conducted at Southend University Hospital NHS Foundation Trust, Southend, UK in the year 2017.

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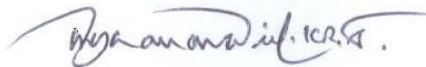
OVERVIEW OF THE PROJECT

“A quality improvement project using Iterative Plan Do Study Act cycles to improve the time efficient patient centred care for acute renal colic patients in the Emergency Department at a District General Hospital by implementation of an Acute Renal Colic management Pathway that enables early diagnosis, Urology follow-up arrangements and reduction in hospital admissions”

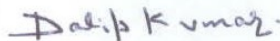
Period: February 2017 to November 2017

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Appendices and Evidences are attached separately at the end to support the QIP.

Improvement of time efficient patient centred care for acute renal colic patients in the Emergency Department

ABSTRACT

Background: Acute renal colic patients, after imaging and adequate resolution of pain, in the absence of complications and high risk factors can safely be discharged from Emergency Department with appropriate follow-up. Although a national guideline or a pathway does not exist for the management of acute renal colic, there are recommendations from various societies and literature for the management of these patients.

Problem: Due to the lack of appropriate local guidelines, there were issues in the management of acute renal colic patients in this district general hospital contributing to delayed diagnosis, inappropriate follow up and unnecessary admissions.

Aim: The aim of this quality improvement project was to improve the time efficient patient centred care, by improving the CT KUB availability, ensuring a Urology follow-up plan and reducing the hospital admissions.

Method: This is a quality improvement project using the Plan Do Study Act cycles to evaluate and implement changes. The Acute Renal Colic management pathway (ARC pathway) was developed and implemented after required approval from all relevant stakeholders. The ARC pathway incorporated early diagnosis, allowed for necessary admissions and ensured a safe discharge plan with appropriate follow up arrangements. Sufficient training was provided before and after implementation of the pathway. The processes measured were the compliance percentage for ARC pathway completion, compliance percentage for CT KUB utilisation and that for Urology follow-up referrals. The final outcome measure was the total percentage of hospital admissions for these patients.

Results: After implementation the of ARC pathway, the percentage of patients who had CT KUB directly from ED improved to 85.5% from 34.7% pre pathway while the Urology follow-up arrangement, which did not exist pre pathway, showed a compliance rate of 95.6% post

pathway. The total percentage of admissions came down from 78.2% to 27.2% by avoiding unnecessary admissions in 5 months after implementation of the pathway.

Conclusion: This project shows introduction of a structured pathway with required training will have a positive impact on delivery of care for this patient group.

INTRODUCTION

Acute renal colic is one of the commonest urological conditions presenting to the Emergency Departments (ED) with a life time stone occurrence rate of about 12% in men and 6% in women¹. The number of renal colic patients presenting to the ED is increasing, with peak incidence¹ occurring between 40 and 60 years of age for men and in late 20s for women. Initial management, including diagnosis, is important as about 3% to 10% of similar presentations can have other acute diagnoses². Professional organisations^{3,4} have developed evidence based recommendations for the assessment and management of these patients.

Problem:

Most of the acute renal colic patients, presenting to the ED at Southend University Hospital NHS Trust, after initial assessment and treatment, but prior to the Computed Tomography of Kidneys Ureters and Bladder (CT KUB) were either admitted under Surgery team or discharged to General Practitioners (GP) for further investigations and follow-up. This was predominantly due to the lack of imaging protocols and appropriate follow up arrangements. Unsurprisingly, these issues caused delay in diagnosis and lack of follow-up of patients. Importantly, there was a considerable amount of unnecessary acute admissions with no benefit to patients but adding on to the pressure for acute beds and exposing such patients to additional risks through hospital admission.

Background:

Around three-quarters of all emergency admissions in the UK come via Emergency Departments⁵. In the fourth quarter of 2016 – 2017, there were 1.45 million emergency admissions out of which 1.05 million were from the ED⁵. Hospital admissions are associated with increased risk of adverse events⁶ such as hospital acquired infections, venous-thromboembolic events, drug errors, increased financial burden and increased pressure on acute beds⁶. However, admission should be recommended if it would be beneficial for the patient rather than recommending admission as a safe disposal⁷. Guidelines should be developed based on systematically collected scientific evidence⁷, allowing for necessary admissions if benefits outweigh risks and allowing for rational decision making by clinicians when substantial uncertainty regarding the probability of benefit exists⁷. A literature review was undertaken to gather evidence for the management of acute renal colic in the ED, especially with respect to the timing of imaging, features necessitating hospital admission and those allowing outpatients management. The current evidence^{1,3,4,8} mandates immediate imaging and hospital admission if the symptoms are not well controlled^{1,3,4,8} or if there is any complication^{1,3,4,8} (such as infection, acute kidney injury or sepsis) or a high risk factor^{1,3,4,8} (such as kidney transplant, solitary kidney, bilateral renal colic or renal insufficiency). Evidence also suggests that the patients with adequate pain resolution, no complications and no risk factors, may not need immediate imaging^{1,4} and can be managed as outpatients^{1,4} provided an urgent imaging within a specific timeframe^{1,4} is ensured. The expert opinion on the timeframe is that the imaging should be done within 7 days^{1,4}. However, a short-cut systemic review⁹ that was carried out to establish the evidence for safe discharge of uncomplicated renal colic patients presenting to the ED concluded that the current evidence does not support the safe discharge of these patients from the ED, before imaging. Hence, due to the lack of clear evidence for the timing of imaging and the safe discharge from the ED for this sub group of patients, it is imperative to develop a protocol that employs the efficient use of available resources to obtain imaging at the earliest possible and before discharge from the ED. Such a protocol may ensure patient safety, early

diagnosis and safe discharge. Spontaneous stone passage occurs in many cases^{1,8} without immediate intervention or with the help of medical expulsive therapy,^{1,3,8} depending on the stone size and location. Non contrast CT KUB is the gold standard imaging for renal colic, with a sensitivity of 96.6% and specificity of 94.9%^{1,3,4,8}. In the light of the literature evidence and the recommendations from the professional organisations, a structured pathway was needed to improve the management of acute renal colic patients at this centre.

Setting:

This quality improvement project was conducted in a busy Emergency Department, at Southend University Hospital NHS Foundation Trust, UK. The ED at this district general hospital sees over 280 patients per day on average and the number of patients attending this ED with acute renal colic averages around 30 patients per month. The project included the patients over 20 years of age presenting to ED with clinically suspected acute renal colic. Patients less than 20 years of age, pregnant women and recurrent renal colic patients were excluded from the project as these patients would need early specialist assessment and or different imaging modality^{1,3,8} than CT KUB as per current recommendations. The staff group involved were the ED Clinicians, Radiology (Radiographers and Radiologists), Clinical decision unit (CDU), General Surgery and Urology.

Aim:

The aim of this project was to improve the time efficient patient centred care for acute renal colic patients by: -

1. Improving the CT KUB availability directly from ED for 80% of patients to enable early diagnosis
2. Ensuring Urology follow-up arrangements for more than 80% of discharged patients and
3. Reducing the hospital admissions of these patients by 30%

before the end of November 2017 (a period of 10 months from the start of this project)

METHOD

This is a quality improvement project (QIP) conducted at a single district general hospital over a period of 10 months (February 2017 to November 2017). Iterative Plan Do Study Act (PDSA) cycles were utilised to evaluate the impact of changes until the desired outcome was achieved.

A previous clinical audit on the management of acute renal colic, completed in this ED (July 2016) was reviewed and the recommendations were noted (Appendix 1). A retrospective analysis to ascertain the number of patients who had CT KUB directly from ED, follow up arrangements made by the ED Clinicians, and the number of admissions to the surgical ward for this group of patients was done (details in Tables 1 and 2). A questionnaire survey was also used to assess ED clinicians' practise and to consider their expectations in improving the management of these patients (Appendix 2). In order to achieve the patient centred care and to avoid unnecessary admissions for acute renal colic patients presenting to ED, a management pathway was prepared incorporating early diagnosis, appropriate referral arrangements and Urology follow-up plan. It was recognised that there was no single nationally agreed pathway that existed for the management of these patients in the UK and hence the recommendations from British Association of Urology Surgeons (BAUS), European Association of Urology (EAU), National institute for Clinical Excellence (NICE), currently available evidence in the literature and expert advice were used to frame a pathway. After involving all the stake holders including ED Consultants, Radiology Consultants, Radiology Manager, Urology Clinical Director and General Surgery team, the Acute Renal Colic management pathway (ARC Pathway) was finally agreed. This was then approved by the Documents Management Group (DMG) of the Trust and was later implemented on 3rd July 2017 (ARC Pathway – Appendix 3).

According to the ARC pathway, patients over 20 years of age with clinically suspected acute renal colic, presenting to the ED between 9am and 8pm (7 days a week) will have CT KUB directly from the ED. Following the CT KUB, patients with stone disease, meeting the discharge criteria as defined on the pathway, will be discharged from ED with a referral to stone clinics made via email, so as to be followed up by the Urology team directly (Urology referral form – Appendix 4). The discharge advice and prescription advice were also included on ARC pathway for ED Clinicians to act upon discharging their patients. A patient information leaflet on kidney stones (Appendix 5) was also developed and made available for better information to the discharged patients. These patients will be followed up by the Urology team later in the Stone Clinic. For similar patients presenting to the ED between 8pm and 9am, initial assessment and treatment will be done in ED and then a decision will be made whether they are uncomplicated renal colic based on the criteria in the ARC pathway. These criteria were developed from the current literature evidence^{1,4,8,9} and the expert opinion (ED, Urology and Radiology Teams at this centre). Patients fulfilling all the criteria for uncomplicated renal colic will then be transferred to Clinical Decisions Unit (CDU) awaiting CT KUB at 08.30 am on the immediate morning (2 CT KUB slots at 08.30 am 7 days a week were exclusively provided by Radiology for these out of hours' patients from ED, to avoid delays), following which they will be reviewed by a Urology Consultant within 1 hour in the Surgical Assessment Unit (SAU), as ambulatory patients (CDU transfer from – Appendix 6). The rationale behind transferring these uncomplicated renal colic patients to CDU awaiting CT KUB is to ensure patient safety as the current evidence does not support safe discharge of patients prior to imaging and that CT KUB is not available at these hours in this hospital as the CT requests are outsourced and are restricted to more urgent CT investigations only. Those patients who do not fulfil the uncomplicated renal colic criteria on initial assessment will then be referred to the on call Surgery team for immediate further investigations and management as per their assessment. A Radiologist will report all CT KUBs within 1 hour of imaging and it was agreed that the CT KUB requests for out of hours' patients need not be discussed with the Radiologist for approval (no vetting required for

requests made between 8pm and 9am for patients having CT KUB on the immediate morning at 08.30am).

Inclusion and exclusion criteria, initial management of renal colic in ED and alternative diagnoses to be considered were also included on the ARC pathway to guide the ED clinicians. Each and every step was clearly explained and the ARC pathway was colour coded for ease of use. By implementing this structured pathway, CT KUB will be done directly from ED enabling early diagnosis for patients. It will also guide the ED Clinicians to make appropriate decisions, either to admit or safely discharge patients (depending on criteria on the pathway) with adequate advice and Urology follow up, ensuring patient safety. This will result in reducing the number of admissions for this group of patients, by allowing necessary admissions but avoiding unnecessary admissions, thus improving patient convenience.

For the whole process to be effective, adequate time was reserved for education (between May and July 2017), prior to the implementation of the pathway. Teaching and training were provided for all the users of the pathway including ED Clinicians, Nursing staff, Radiology team, CDU staff, Urology team and the General Surgery team on various occasions. Trust emails and posters were also used to disseminate and advertise the ARC pathway, explaining the advantages for the patients. PDSA cycles were used to evaluate the effects, and data collection was done from the date of implementation to measure the processes and the outcome. A clinical audit was also conducted 3 months after the implementation of the pathway and the results were shared in the audit meeting.

The processes measured were

1. Compliance percentage for ARC pathway completion: This was chosen to evaluate and improve the adherence to the pathway so as to ensure consistent practise among the ED clinicians. The percentage of patients with the completed pathway was aimed at more than 90% from the outset.
2. Compliance percentage for CT KUB utilisation: This measure was chosen to ensure most of the ED patients benefit from the CT KUB arrangements directly from ED which would enable early diagnosis and safe discharge from ED. The compliance rate was aimed at 90%.
3. Compliance percentage for Urology Out-Patients Department (OPD) follow-up arrangement: The patients discharged from ED should have Urology OPD follow-up arranged at the point of discharge, to ensure continuity of care. The percentage of compliance was aimed at more than 90%.

All of these processes were easily measurable, valid and reliable as they were collected from the patients' clinical record with the help of Trust's Audit team and were cross checked using Medway (ED patient record), ICE system (Investigations Reporting System), CED patient portal (patient records) and PACS (Radiology system).

The final outcome measure was the total percentage of admissions after implementation of the pathway and this was compared to that of prior to implementation.

PDSA cycle 1 (July 2017): The ARC pathway was implemented on 3rd July 2017 as planned. Training of the pathway was continued during this cycle in July 2017 and the ED board rounds (at 8am and 3pm) were used to increase the awareness regarding availability and the use of the pathway. Hard copies of ARC pathway were placed in a set of drawers which was kept in a more accessible and visible area, for the ED Clinicians to use. The CDU transfer forms and the Urology referral forms were also placed in the same set of drawers. The data collection to measure the processes was done during this cycle, following the

implementation. The functioning of Urology referral process was checked with the Urology team and they confirmed that the referrals (via email using the Urology referral forms) were picked up as planned and the patients were followed up appropriately. As suggested by the Urology team, a minor correction was made on the referral form to include drug history. There were a few problems initially with the use of the pathway by the junior doctors and the Radiology department (CT radiographers). Feedback regarding the use of the pathway was shared with the ED clinicians and the CT radiographers, both personally and via emails.

PDSA cycle 2 (August 2017): Data collection was continued in August 2017, to measure the compliance percentages for ARC pathway completion, CT KUB utilization and Urology follow-up arrangement. Initially during this cycle, the compliance rates were less than the targets, which were attributed to the new Doctors intake, but these were seen to improve with further education. Large laminated posters of ARC pathway were made available on the ED notice boards, ED Doctors' office, CDU and Radiology to improve dissemination of information. A question and answer session was conducted by the ED Guidelines lead, where ARC pathway was largely appreciated by the ED clinicians. A correction on the CDU transfer form was suggested during this session which was immediately rectified and the CDU staff members were up dated on this. The soft copy of ARC pathway along with associated documents (CDU transfer form and Urology referral form) were added to the Clinical guidelines folder on the A&E drive of the computer under the name 'Acute Renal Colic folder' as requested by the users for ease of reference. A recommendation was made to add the pathway to the ED's induction curriculum to avoid the problems during new Doctors intake.

PDSA cycle 3 (September 2017): During this cycle in September 2017, in order to encourage the ED Clinicians and to enhance the provider engagement, a presentation illustrating the progress in the use of the ARC pathway, usage of CT KUB and the use of Urology follow-up arrangements was done in the Audit meeting and the Registrar teaching

session. ED Clinicians' contribution towards the improvement in the management of these patients were highlighted and appreciated. Continuous evaluation of the effects was carried out throughout the cycle and the data showed considerable improvement in compliance.

PDSA cycle 4 (October 2017 to November 2017): The use of the ARC pathway was continued and no new interventions were planned for this cycle from October 2017 to November 2017. The processes and the outcome were measured to assess the effectiveness of the ARC pathway. An audit was registered with the Trust and was conducted during this cycle to establish the overall impact of the pathway (Oct 2017 – Audit summary – Appendix 7). Data was collected for the number of admissions in this patient group from the date of implementation of the ARC pathway to compare with the admissions prior to the pathway and the results were found to be encouraging.

RESULTS

The data collection was done over 5 months since the implementation of the ARC pathway. Training was given to the providers before and after the implementation of the pathway. Adherence to the ARC pathway, utilisation of CT KUB and follow-up arrangements were measured during the PDSA cycles. Initially these measures were encouraging as the users showed enthusiasm in using the pathway but the compliance rates fell during the 2nd PDSA cycle due to the intake of new Doctors in the ED. Hence further training was instituted including dissemination of information through posters, emails and feedback sessions. All these interventions contributed to the improvement in the compliance rates as observed in the 3rd and 4th PDSA cycles and the number of admissions decreased considerably.

Pre Pathway: The data collection showed 101 patients (excluding patients less than 20 years old, pregnant women and recurrent renal colic patients) who attended ED with renal colic over the 5 months' period between September 2016 and January 2017. There were 70 males and 31 females with a mean age of 51 years.

Of these 101 patients, 35 had CT KUB directly from ED, 47 had CT imaging from surgical ward after admission (43 CT KUB and 4 other CT imaging) and 19 did not have any imaging. This means only 34.7% of patients were imaged directly from ED while 46.5% were imaged from the surgical ward, contributing to the delay in diagnosis and unnecessary admissions while 18.8% did not have any imaging. Details are shown in Table 1.

Table 1: Percentage of patients who had CT KUB from ED – Pre Pathway

Months	Number of renal colic patients	Number of CT KUB from ED	Percentage of patients who had CT KUB from ED
Sept 2016	23	8	34.7%
Oct 2016	27	11	40.7%
Nov 2016	22	8	36.3%
Dec 2016	14	3	21.4%
Jan 2017	15	5	33.3%
TOTAL	101	35	34.7%

Among those 35 patients who had imaging completed from ED, 32 were admitted and 3 were discharged home without any specific follow up. Out of those 19 patients who did not have any imaging, 12 were discharged to GP for further investigations and 7 were discharged home with no follow up arrangements. In total 10 patients (3 after CT KUB and 7 without any imaging) did not have any follow-up. Details are shown in Table 2.

Totally 79 out of 101 patients were admitted to the surgical ward (range 12 to 21 admissions per month). The total percentage of admissions prior to the implementation of the pathway was 78.2% (range 69.5% to 86.6%). This is also shown in Table 2.

Table 2: Follow-up arrangements and Percentage of admissions – Pre Pathway

Months	Number of renal colic patients	Number of patients admitted	Number of patients discharged to GP	Number of patients with No Follow-up	Percentage of admissions
Sept 2016	23	16	4	3	69.5%
Oct 2016	27	21	5	1	77.7%
Nov 2016	22	17	2	3	77.2%
Dec 2016	14	12	0	2	85.7%
Jan 2017	15	13	1	1	86.6%
TOTAL	101	79	12	10	78.2%

Post Pathway: The data collection, from July 2017 to November 2017 (5 months), included 110 patients after exclusions. There were 66 males and 44 females with a mean age of 49 years (Mean age: 51 years pre pathway versus 49 years post pathway). PDSA cycles: PDSA 1: July 2017, PDSA 2: Aug 2017, PDSA 3: Sept 2017, PDSA 4: Oct 2017 – Nov 2017.

Table 3: Compliance Percentage for ARC Pathway completion

Months	Number of Renal colic patients	Number of patients 9am to 8pm	Number of patients with Pathway 9am to 8pm	Number of patients 8pm to 9am	Number of patients with Pathway 8pm to 9am	Total number of Pathways completed	Compliance Percentage for ARC Pathway completion
July 2017	22	14	14	8	6	20	90.0%
Aug 2017	25	15	12	10	9	21	84%
Sept 2017	19	13	12	6	6	18	94.7%
Oct 2017	23	14	14	9	8	22	95.6%
Nov 2017	21	13	12	8	8	20	95.2%
TOTAL	110	69	64	41	37	101	91.8%

101 patients had the ARC pathway completed with a compliance percentage of 91.8%. The details of compliance percentage for ARC pathway completion, for each month during PDSA cycles are included in Table 3.

As directed by the ARC pathway, 100 out of 110 patients should have had a CT KUB directly from the ED and the remaining 10 should have been referred to the surgical team prior to imaging. The data showed 94 patients had a CT KUB from the ED with a compliance rate of 94% for CT KUB utilisation (Table 4), while the overall percentage for CT KUB improved to 85.5% (94/110) as opposed to 34.7% pre pathway, thus contributing to early diagnosis.

Table 4: Compliance percentage for CT KUB utilisation

Months	Number of Renal colic patients	Number of patients to have CT KUB from ED	Number of patients who had CT KUB from ED 9am to 8pm	Number of patients who had CT KUB from ED 8pm to 9am	Total number of patients who had CT KUB from ED	Compliance Percentage for CT KUB Utilisation
July 2017	22	20	14	4	18	90%
Aug 2017	25	22	12	7	19	86.3%
Sept 2017	19	18	13	5	18	100%
Oct 2017	23	21	14	6	20	95.2%
Nov 2017	21	19	13	6	19	100%
TOTAL	110	100	66	28	94	94%

69 patients attended between 9am and 8pm, out of which 53 were discharged and 16 were admitted to the surgical ward. 41 patients attended between 8pm and 9am, out of which 27 were sent to CDU (awaiting CT KUB the following morning and Urology review as ambulatory patients) and 14 were admitted to the surgical ward. Out of the 53 patients discharged from ED, 44 had Urology OPD follow-up arranged on discharge, 7 did not need any follow up and 2 were missed for follow-up. The compliance percentage for Urology OPD follow-up arrangement was 95.6% and the details for each month are shown in Table 5.

Table 5: Compliance percentage for Urology OPD follow-up arrangement

Months	Number of renal colic patients	Number of renal colic patients discharged from ED	Number of patients who needed Urology OPD follow-up	Number of Urology OPD referrals made at discharge	Compliance percentage for Urology OPD follow-up
July 2017	22	12	11	10	90.9%
Aug 2017	25	9	8	7	87.5%
Sept 2017	19	10	8	8	100%
Oct 2017	23	11	9	9	100%
Nov 2017	21	11	10	10	100%
TOTAL	110	53	46	44	95.6%

This Urology follow up plan did not exist prior to the implementation of the pathway. The compliance, on the whole, improved through the PDSA cycles and our data shows 100% compliance for CT KUB utilisation and Urology OPD referrals during the 3rd and 4th PDSA cycles.

Table 6: Percentage of admissions Post Pathway - between 9am and 8pm

Months	Number of renal colic patients	Number of patients 9am to 8pm	Number of patients admitted	Number of patients discharged	Percentage of admissions
July 2017	22	14	2	12	14.2%
Aug 2017	25	15	6	9	40%
Sept 2017	19	13	3	10	23%
Oct 2017	23	14	3	11	21.4%
Nov 2017	21	13	2	11	15.3%
TOTAL	110	69	16	53	23.1%

Table 7: Percentage of admissions Post Pathway - between 8pm and 9am

Months	Number of renal colic patients	Number of patients 8pm to 9am	Number of patients sent to CDU	Number of patients admitted	Percentage of admissions
July 2017	22	8	4	4	50%
Aug 2017	25	10	6	4	40%
Sept 2017	19	6	5	1	16.6%
Oct 2017	23	9	6	3	33.3%
Nov 2017	21	8	6	2	25%
TOTAL	110	41	27	14	34.1%

In total, 30 out of 110 patients were admitted (range 4 to 10 admissions per month), 16 between 9am and 8pm (16/69 – 23.1%, Table 6) and 14 between 8pm and 9am (14/41 – 34.1%, Table 7). The total percentage of admissions was 27.2% (range 19% to 40%; 95% CI 19.4% - 33.8%, Table 8). The final outcome measure, total percentage of admissions, significantly decreased from 78.2% pre pathway down to 27.2% post pathway (Table 9). The percentage of reduction in admission was 51% after the implementation of the ARC pathway over a period of 5 months.

Table 8: Percentage of admissions Post Pathway – 24 hours

Months	Number of renal colic patients	Number of patients admitted	Percentage of admissions
July 2017	22	6	27.2%
Aug 2017	25	10	40%
Sept 2017	19	4	21%
Oct 2017	23	6	26%
Nov 2017	21	4	19%
TOTAL	110	30	27.2%

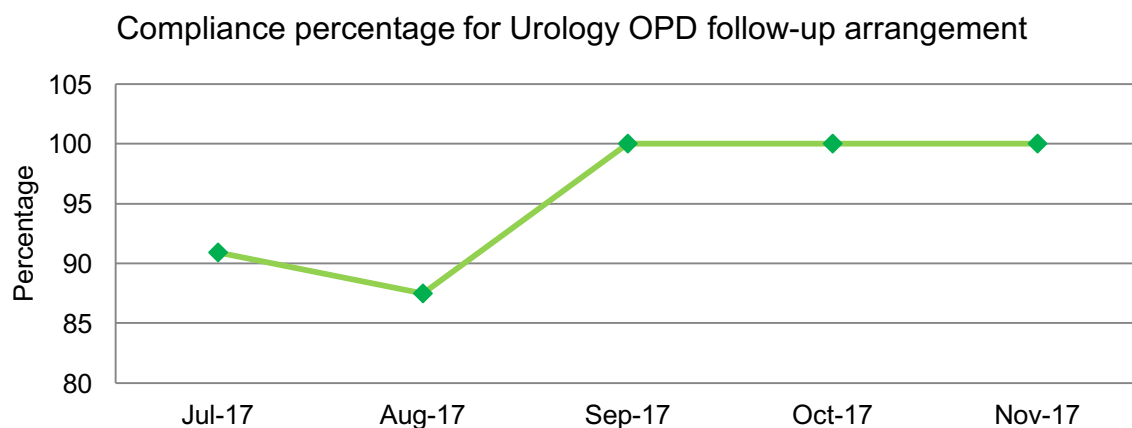
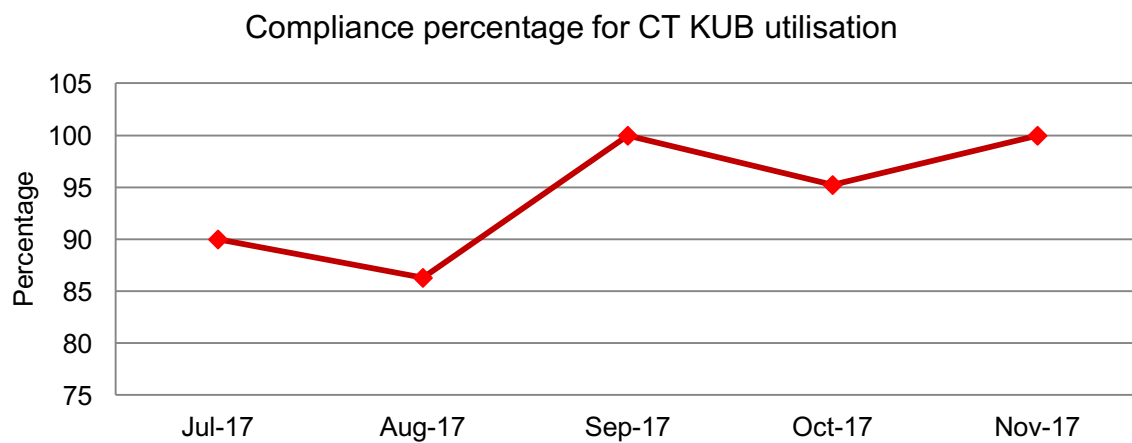
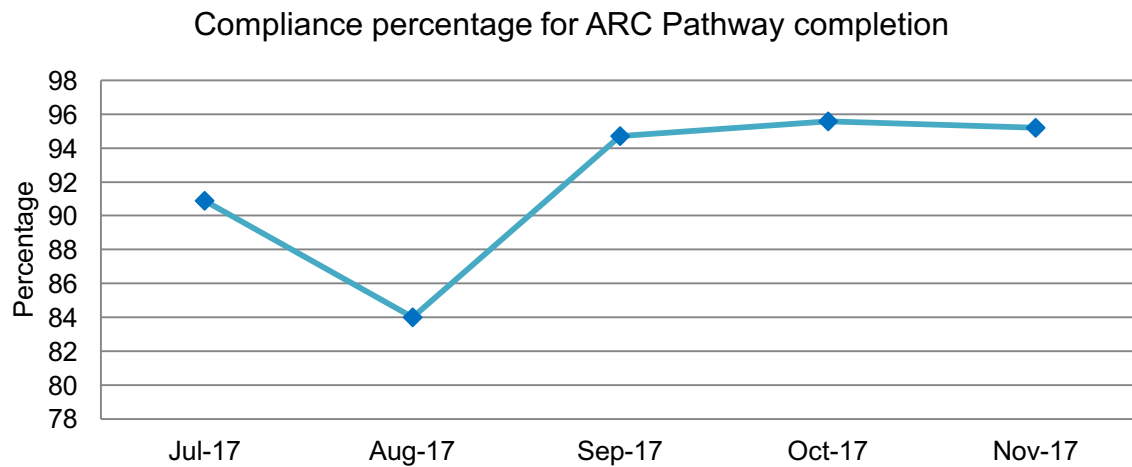
Table 9: Percentage of admissions for comparison – Pre and Post Pathway

Period for comparison	Number of renal colic patients presented to ED	Number of patients admitted	Percentage of admissions
Pre Pathway (Sept 2016 to Jan 2017)	101	79	78.2%
Post Pathway (July 2017 to Nov 2017)	110	30	27.2%

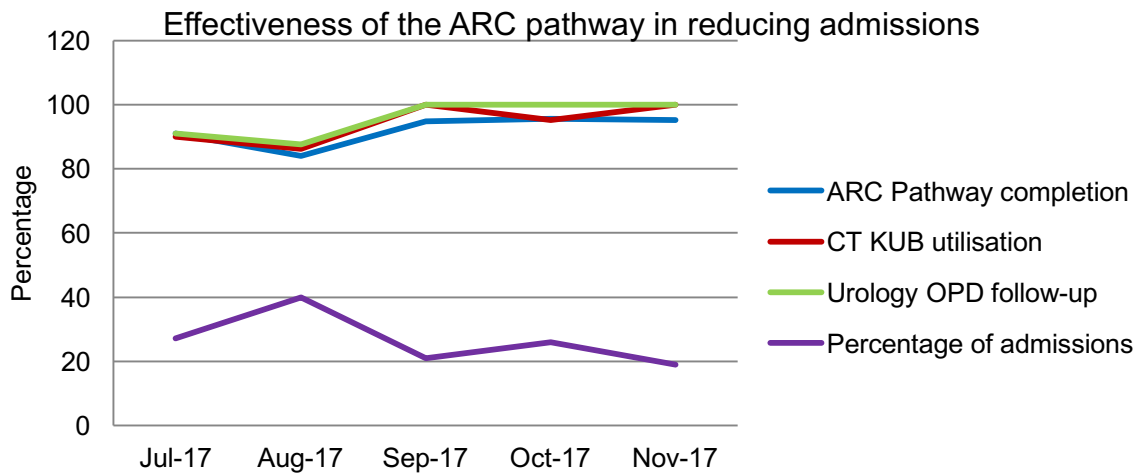
Reduction in admissions by avoiding unnecessary admissions: 51%

The run chart illustrating the association between processes and outcome measures, pie charts showing the improvement in follow-up arrangement along with reduction in admissions and the bar chart displaying the reduction in admissions are shown below. Our data reveals that the improvement in adherence to all elements of the pathway contributes to improved care for patients by reducing unnecessary admissions. Consequently, we expect this ARC pathway to be cost effective too, by reducing the bed day cost which is £382 per patient per day (as confirmed by the Trust's Finance manager). All the data was collected with the help of Trust's audit team using patient's clinical notes and were cross checked as mentioned earlier. Hence the data is expected to be as correct as possible although minimal data could have been missed due to the complexity of the elements involved, but may not have significant influence on the results. (Pre and Post Pathway data: Appendix 8, 9 & 10)

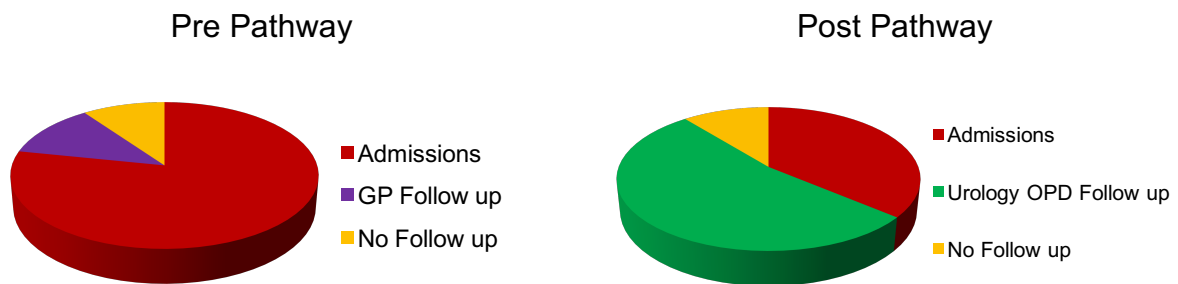
Run charts below show the progression of the processes through the PDSA cycles after the implementation of ARC pathway from July 2017 to November 2017.



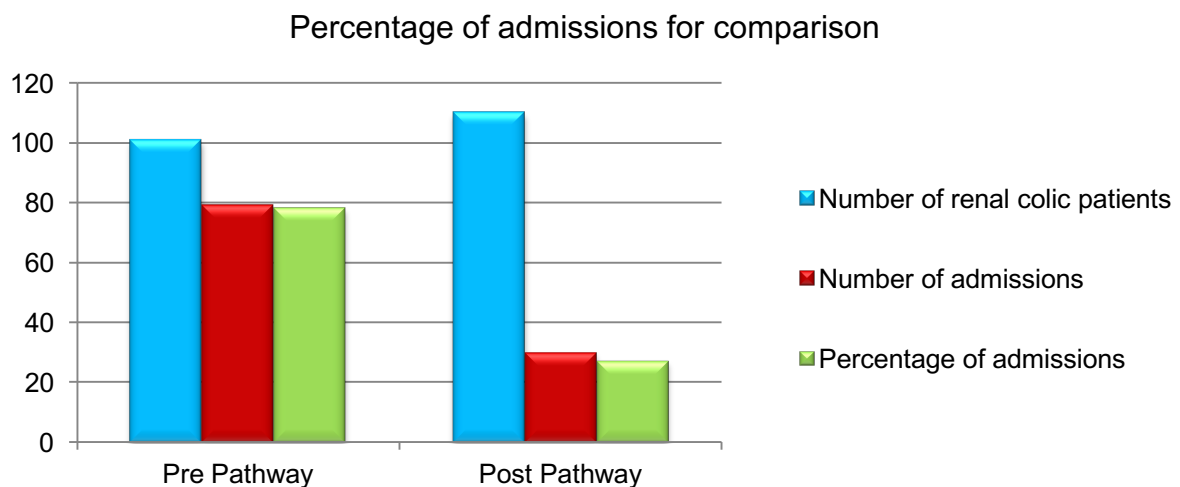
Run chart below demonstrates the relationship between the processes (blue, red and green) and the outcome (purple).



Pie charts below reveal the improvement in follow-up arrangement and reduction in admissions and after the implementation of the ARC pathway.



Percentage of admissions considerably decreased after the implementation of ARC pathway as shown in the bar chart below.



DISCUSSION

Impact of the ARC Pathway:

The application of ARC pathway and all the interventions during the PDSA cycles have had a positive impact on the patients, the system, the Clinicians and the standard of care

- Patients: Adherence to all elements of the pathway contributed to an improved care by standardising CT KUB, ensuring Urology follow-up, enabling safe discharge from ED and avoiding unnecessary admissions which were all in favour of the patients.
- System: This pathway has reduced the admissions for this group of patients by 51% and hence helped to reduce the pressure for acute beds in the Hospital. In addition, it has been cost effective too, by reducing the bed day cost of £382 per patient per day.
- Clinicians: This project has standardised the ED Clinicians' practice and there were positive comments from the Clinicians after the implementation of the pathway. It has successfully steered to the change of practice.
- Standard of care: The results are comparable to the Royal College of Emergency Medicine's Renal colic audit standards 2012 – 13 (Appendix 11), especially in the domains of imaging and follow-up arrangements.

Challenges:

However, the whole process was not without challenges. Once a pathway was developed initially based on the literature evidence and the recommendations from professional organisations, certain changes were made to the pathway after several discussions with the stake holders including ED Consultants, Radiology Consultants, Radiology Manager, Urology Clinical Director and General Surgery team to suit the local resources and requirements. CT KUB provision for requests from ED was agreed with the Radiology team to ensure early diagnosis following a detailed presentation at the Radiology directorate meeting. The follow-up arrangements for the patients with stone disease were discussed and agreed with the Urology team. The largest barrier encountered was in engaging all the

stake holders to approve the pathway which was time consuming and challenging. This was eventually overcome by continuous persuasion with the rationale, by using the influence of the ED Clinical director and with the help of the ED Guidelines lead. After the satisfactory approval, the ARC pathway was then implemented for clinical use.

Considering the complexity and the involvement of various team members at varied levels of knowledge, streamlining them into a pathway could be demanding. But this was overcome by developing a good rapport with the entire team and by addressing their concerns and expectations, right from the start of the pathway development. Hence, when implemented, the ARC pathway was received with enthusiasm.

Sustainability:

Sustainability of the pathway is integral for improvement of care and hence several measures were undertaken right from the initial stages of the project. These included agreement from all the stake holders, approval from the DMG (making the pathway as a clinical document to be added to patient's clinical notes), addition of the pathway to the ED clinical guidelines, addition of the pathway to the ED induction curriculum for new Doctors and also by empowering the radiographers to accept for imaging only if the ARC pathway accompanied the patient to the CT room. Appropriate training and feedback were given to improve the provider engagement. There were no major concerns raised by the users and their feedback was addressed through a question and answer session which led to a minor correction on the associated document (CDU transfer form). The success and the improvements were disseminated to the team as part of appreciation of their engagement. All these interventions helped in arriving at the desired final outcome. As recommended, the introduction of the ARC pathway to the new Doctors was done at their induction on 6th December 2017. Continuous monitoring and evaluation are essential to safeguard sustained success and augment improvements.

As already stated, a nationally agreed pathway for the management of renal colic patients does not exist. The imaging protocol varies in different centres across the UK according to the local resources. A renal colic fast track pathway to improve waiting times and outcomes for patients presenting to the ED was implemented at a local hospital in the UK and the results were published recently in 2017¹⁰. This study examined the use of a fast track renal colic pathway for a large patient group and concluded that it is a safe and efficacious method of reducing diagnostic delay and improving patient flow in the ED.

LIMITATIONS AND REFLECTION

Introduction of a guideline or a pathway requires various skills and team work. Ample time has to be reserved for preparation, approval, training, implementation and evaluation. Nevertheless, the whole process is a very good learning curve and is rewarding too.

The perfection of the ARC pathway is limited to the availability of resources and hence efficient use of such resources with sufficient support from the multidisciplinary professionals is the key to success. Due to the lack of clear evidence to discharge acute renal colic patients prior to imaging and due to the lack of availability of CT KUB overnight in this hospital setting, the patients presenting to the ED after 8pm, those who are risk stratified as uncomplicated renal colic, are sent to CDU awaiting CT KUB the following morning. From the hospital's perspective CDU transfers are not recognised as admissions, but patients' perspective may be different as they have to stay longer in the hospital. Hence these have to be factored in as admissions and that reduces the reduction in admissions from 51% to 26.4% (Table 10). Although this limitation could be attributed to the imprecision in the system, patient safety has been ensured in the ARC pathway. An admission to CDU is likely to be shorter than an admission under Surgery, but this has not been specifically measured in this project. Nonetheless, there is a considerable reduction in admissions by 26.4% as compared to the pre pathway period.

Table 10: Percentage of admissions Post Pathway – including CDU transfers

Months	Number of renal colic patients	Number of patients sent to CDU	Number of patients admitted	Number of admissions including CDU	Percentage of admissions including CDU
July 2017	22	4	6	10	45.4%
Aug 2017	25	6	10	16	64%
Sept 2017	19	5	4	9	47.3%
Oct 2017	23	6	6	12	52.1%
Nov 2017	21	6	4	10	47.6%
TOTAL	110	27	30	57	51.8%

Reduction in admissions, including CDU as admissions: $78.2\% - 51.8\% = 26.4\%$

During the study period, although fit for CDU transfer, 2 patients were admitted to surgical ward due to overcrowding in CDU and such circumstances may arise from time to time. These 2 patients were included as admissions in this study which otherwise could have contributed to further reduction in admissions.

All elements of this ARC pathway may not be applicable in major hospitals where the imaging availability may be different whereas in smaller centres the lack of CDU facilities may restrict its use during out of hours. Yet, this quality improvement project shows that a structured pathway designed to the local requirements ensuring the best use of available resources will have a considerable impact on patient care.

A further quality improvement project is required to see if the uncomplicated acute renal colic patients could be sent home rather than to CDU with a plan to bring them back as ambulatory patients the following morning for CT KUB and follow-up. This may further reduce admissions and improve patient's convenience. The criteria defined on this pathway for uncomplicated acute renal colic may be a useful tool to evaluate this and such a QIP may help to provide evidence in this context. The use of Point of Care Ultrasound may be considered in these circumstances for low risk patients in the absence of CT, as there is growing evidence in the use of ultrasound⁸, but this needs further study and also requires considerable training for ED clinicians in the use of ultrasonography of KUB.

CONCLUSIONS

The development and implementation of the ARC pathway has established substantial improvement in the time efficient patient centred management of acute renal colic patients presenting to this Emergency Department. It has ensured reduction in unnecessary admissions by enabling early diagnosis and safe discharge of patients from ED with a planned follow-up. Stake holders' involvement, provider engagement, training and feedback were all pivotal in sustaining the impact.

Recommendations:

This pathway could be useful in similar hospitals with similar resources to deliver better care for this group of patients. Further study is required and has been suggested to be conducted in this Emergency Department, to avail immediate imaging overnight which would further reduce admissions and would allow comparable care for all the patients irrespective of the time of presentation.

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APPENDICES

1. Appendix 1: Renal colic Audit summary – July 2016
2. Appendix 2: Questionnaire survey
3. Appendix 3: Acute renal colic management pathway (ARC Pathway)
4. Appendix 4: Urology referral form
5. Appendix 5: Kidney stones Leaflet (Patient information leaflet)
6. Appendix 6: CDU Transfer form
7. Appendix 7: Renal colic Audit summary – Oct 2017
8. Appendix 8: Pre Pathway data (Sep 2016 to Jan 2017)
9. Appendix 9: Post Pathway data – Day (Between 9am and 8pm – Jul 17 to Nov 17)
10. Appendix 10: Post Pathway data – Night (Between 8pm and 9am – Jul 17 to Nov 17)
11. Appendix 11: RCEM Renal colic audit 2012-13 (National audit)

EVIDENCES

1. ED Directorate Meeting - Minutes
2. Evidence of support from the ED Clinical Director – email – to expedite the process
3. Evidence of Guideline development – Management e-portfolio
4. Urology meetings – Minutes and email chain
5. Evidence of Communication and Meetings with Radiology Directorate – Minutes and email chain
6. Evidence of DMG Meeting – for approval of the ARC Pathway
7. Information on cost analysis (from Trust's Finance Manager)
8. Communication, feedbacks after approval and implementation of the ARC Pathway
9. Audit – Completion Certificate from the Trust Audit team
10. QIP – Completion Certificate from the Trust Quality improvement team