


# BMJ Open Quality Improving the diagnostic pathway in patients presenting with acute kidney injury secondary to de novo multiple myeloma: a short report

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## INTRODUCTION

Multiple myeloma (MM) has a prolonged diagnostic pathway, with a median time to diagnosis of 163 days.<sup>1</sup> Renal impairment is a common complication of MM and is associated with worse outcomes. Cast nephropathy resulting in acute kidney injury (AKI) is a medical emergency and the time to initial treatment with chemotherapy is pivotal for renal recovery and patient outcome. Patients can present to various specialties and initial symptoms can be vague, making diagnosis challenging and resulting in diagnostic delay.

In order to identify where delays occur, we reviewed the diagnostic pathway in patients with de novo MM with AKI at two tertiary centres in the UK. We identified delays within this clinical pathway and sought to implement a change in order to speed up the time to disease-specific treatment. Our aim was to improve the timeline to diagnosis by nearly 50%.

## METHODS

We retrospectively reviewed the electronic records of patients who presented to the two centres: University Hospitals Birmingham (UHB) and Oxford University Hospitals (OUH), with AKI of any stage and serum free light chain (sFLC) concentration of  $\geq 500$  mg/L between 1 April 2015 and 31 December 2017. Patients known to have MM were excluded.

## RESULTS

A total of 56 patients were identified, 28 from each centre. **Table 1** summarises the results of the two centres. Patients had most commonly been referred to hospital from primary care (41%). The median time to sFLC request was

1 day and median time to initial treatment with dexamethasone was 5 days. The longest delay was waiting for a bone marrow biopsy, with a median time of 6 days.

The blood test request for sFLC was sent, but there was a significant delay from the test to administration of dexamethasone and bone marrow biopsy. The median time from sFLC request to dexamethasone was 4.5 days (range 0–30) at UHB and 4 days (range 0–28) at OUH. At UHB, the median time to haematology referral following admission was 3 days (range 0–39). This was felt to be due to delay in reporting of sFLC results, lack of communication between teams and slow referral to haematology.

## Intervention

Our intervention was to call through all new sFLC results  $\geq 500$  mg/L by the immunology laboratory directly to the on-call haematology team via phone/email. The intervention aimed to reduce the time to diagnosis by shortening the delay between requesting and reporting of sFLC results  $\geq 500$  mg/L to the haematology team.

A re-audit over a 36-month period (February 2018 to February 2021) at UHB identified 19 patients with AKI, sFLC  $\geq 500$  mg/L and new myeloma; the median time to bone marrow was 3 days (range 1–7) and the median time to dexamethasone was also 3 days.<sup>1–12</sup> The re-audit showed nearly a 50% improvement in the timeline.

We also reviewed the timeline of all patients with a new sFLC result  $\geq 500$  mg/L (irrespective of whether patients had AKI or not) whose results were communicated to the on-call haematology team from February 2018 to January 2019 at UHB. Of the 35 patients whose results were called through by the immunology

**Table 1** Pathway of investigations for patients presenting with de novo multiple myeloma and AKI at two tertiary referral centres

	First centre		Second centre	
Referral pathway (no of patients)	GP	12 (43%)	GP	11 (40%)
	A and E	10 (36%)	AMU	9 (32%)
	Other	6 (21%)	A and E	2 (7%)
			Other	6 (21%)
Median time to first treatment with dexamethasone (days)	5 (IQR 13–3)		5 (IQR 16–3)	
Median time to sFLC test request (days)	1 (IQR 2–0)		1 (IQR 1–0)	
Median time from sFLC request to dexamethasone (days)	4.5 (IQR 12–2)		4 (IQR 14–3)	
Median time to bone marrow (days)	6 (IQR 11–3)		6 (IQR 13–4)	
Dexamethasone prior to bone marrow (no of patients)	6 (21%)		10 (36%)	
Median time (days)	2 (IQR 5–1)		4 (IQR 6–2)	
Dexamethasone same day as bone marrow (no of patients)	10 (36%)		4 (14%)	
Dexamethasone post bone marrow (no of patients)	9 (32%)		7 (25%)	
Median time (days)	8 (IQR 14–3)		7 (IQR 14–1)	
Dexamethasone not received	3 (11%)		7 (25%)	
Renal biopsy (patients)	6 (21%)		5 (18%)	
Median time (days)	2 (IQR 7–2)		4 (IQR 10–2)	

AKI, acute kidney injury; Other, presentation to any other specialty; sFLC, serum free light chain.

laboratory, 9 were new patients with myeloma, 4 were managed as in-patients and 5 were outpatients.

For the four in-patients, median time to bone marrow was 3 days (range 1–7) and time to dexamethasone was 2.5 days (range 1–7); these showed a 50% improvement compared with baseline audit. For the five new patients with myeloma managed as outpatients, the median time to bone marrow was 15 days (range 3–36) and median time to treatment was 29.5 days (range 4–49).

## DISCUSSION

MM has a prolonged diagnostic pathway and delayed diagnosis is associated with worse outcome.<sup>2</sup> Delays occur throughout the pathway from patient presentation to final diagnosis.

A sFLC level  $\geq 500$  mg/L is suggestive of cast nephropathy and requires urgent haematological assessment<sup>3–5</sup> without the need for a kidney biopsy.<sup>4</sup> Patients who have a prompt diagnosis of cast nephropathy and rapid intervention with chemotherapy have better outcomes.<sup>6–8</sup>

The baseline audit showed prompt requests of the sFLC test; however, there was delay in referring to the haematology team, a requirement for progression to bone marrow biopsy and start of disease-specific treatment. Another finding at UHB was that, although the immunology laboratory has a system of in-house reporting of sFLC results within 24 hours 5 days a week, there was often a delay in the results being reported onto the electronic patient record. Also, there was no system of flagging up the abnormal sFLC results to ensure the team had noted and acted on the

abnormal result. sFLC testing remains a specialist test and many clinicians may not be aware of the importance of such an abnormal result.

Following this, we implemented a change in our pathway, and any new sFLC test result  $\geq 500$  mg/L was reported to the on-call haematology team with a note on the patient electronic record of the communication to the relevant team member.

By shortening the time to haematology referral, we minimised delays in directing appropriate patients to haematology in need of disease-specific intervention. As a result of this intervention, we reduced the time to treatment in our patients by nearly 50%.

There have been various initiatives to improve the diagnostic pathway for patients with myeloma<sup>9–11</sup> including the establishment of The Myeloma Early Diagnosis Working Group in 2016.<sup>12</sup> Alternative flagging systems such as auto-generated emails to haematology and/or other push notifications can be used by trusts to improve the timeline to diagnosis in patients with myeloma, although these may not be as targeted as our intervention of direct communication with the relevant team.

Our project provides insight regarding time to diagnosis in the patients with newly diagnosed myeloma in tertiary centres in the UK (with availability of in-house sFLC testing). Not all hospitals have the facility to measure sFLC test at site and this may result in a longer time to diagnosis.

This project demonstrates that targeted communication has the potential to improve the time to diagnosis in patients with MM.

**Correction notice** This article has been corrected since it was published. Table footnote has been corrected.

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