Urine samples produced at patients' own home rarely meet recommendations for analysis

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ABSTRACT

INTRODUCTION: Urinary tract infections are frequently encountered in general practice. For diagnosis, it is recommended to obtain a midstream specimen of urine and immediately inoculate on agar plates, preserve in boric acid or keep cooled until analysis. This study investigated if urine samples produced at home by patients with suspected urinary tract infections are done in accordance with recommendations.

METHODS: The project was conducted at three Danish general practice clinics. When a patient or relative delivered a urine sample produced at home on suspicion of urinary tract infection, he or she was asked to fill in an anonymous questionnaire about the production of the sample.

RESULTS: A total of 60 patients (48 females and 12 males) completed the questionnaire. In all, 22 urine samples were midstream specimen urine. The median time to delivery was 60 minutes. Five samples were delivered within ten minutes of production and therefore characterised as immediate delivery in this study. Eight samples were cooled until delivery; 13.3% met urine analysis recommendations.

CONCLUSION: The findings of this study suggest that urine samples produced at patients' own home on suspicion of urinary tract infection rarely meet recommendations required for further diagnostic analysis.

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Urinary tract infections (UTIs) are frequently encountered bacterial infections, especially in the female population. UTIs account for 2% of the inquiries in general practice. UTIs are categorised into upper and lower UTIs, the latter representing the vast majority. Symptoms may comprise dysuria, pollakiuria, incontinence, pain localised over the bladder and fever [1, 2].

The aetiology of UTIs is uropathogenic bacteria and UTI and UTI are caused by *Escherichia coli* in 65-75% of cases [3]. The concept of a significant diagnostic bacteriuria requiring 100,000 colony-forming units (CFU) was introduced in the 1950s and redefined in 2001, establishing differentiated breakpoints ranging from 1,000 to 100,000 CFU per ml, depending on the species of the uropathogen [4, 5].

To prevent contamination, a diagnostic urine sample must be a midstream specimen of urine (MSU), the importance of which has recently been demonstrated in a Danish study [6]. Although an earlier requirement, pre-void cleansing of the periurethral area is no longer needed. Ideally, the sample is either immediately inoculated on agar plates, preserved in boric acid or kept cooled until analysis can take place. This is so because urine is an excellent growth medium, even when discharged from the bladder, and bacteria continue to replicate at room temperature. A systematic review and meta-analysis from 2016 on this subject found evidence indicating that urine stored at room temperature does show significant overgrowth of bacteria, but after more than four hours only [7]. Though significant replication seems to take several hours, the general recommendation for urine analysis in primary care – as stated in an academically acknowledged and widely distributed booklet for primary care physicians – is for urine samples to be analysed immediately, preserved in boric acid or stored at a low temperature until analysis [8, 9].

Despite this, patients suspecting a UTI often bring a urine sample produced at home to their general practitioner (GP) for analysis.

This study hypothesised that urine samples produced at home due to a suspected UTI that are delivered unannounced to the GP by patients or relatives often do not meet recommendations for further analysis.

METHODS

The authors, three physicians in basic clinical training serving at three GP clinics in the geographically distinct Danish areas of Zealand, Funen and Jutland, created an anonymous questionnaire which was given to the patients or their relatives when handing in an unannounced urine sample produced at home on suspicion of UTI.

In the questionnaire, the patient or relative would fill out: 1) age and gender of the person producing the urine sample, 2) if the sample was delivered by the patient or a relative, 3) at what time the sample was produced and delivered to the GP clinic, 4) if the sample originated from the initial, middle or terminal part of the urination, 5) if the sample was stored at room temperature or cooled and 6) in which type of container the sample was transported.

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Statistics

All data were stored in and statistically analysed. All values are expressed as a median followed by an interquartile range (Q1-Q3).

Trial registration: not relevant.

RESULTS

The data collection period started on 2 January 2019 and concluded on 28 February 2019. A total of 60 patients (48 females and 12 males) completed the questionnaire when handing in an unannounced urine sample; 30 patients from Funen, 12 patients from Zealand and 18 patients from Jutland.

One patient did not state from which part of the urination the sample had been collected and one patient filled in this question explaining that it had been collected from a catheter bag. Among the remaining 58 samples, 27 (46.5%) originated from the initial part of the urination, 22 (37.9%) from the middle part and nine (15.5%) from the final part.

After producing the urine sample, the median time to delivery at the GP clinic was 60 minutes (Q1-Q3: 18.75-118.5 minutes); the longest delay was 900 minutes. Five samples (8.3%) were delivered within ten minutes after urination. Of the 60 samples, eight (13.3%) were stored in a cooled environment until delivery.

In all, 51 samples were provided in clean plastic cups with an improvised lid or clean plastic containers bought from local pharmacies. Nine samples were delivered in unconventional containers encompassing a jam jar, a single use syringe, a honey jar, an empty container of pantoprazole 40 mg tablets, an empty bottle of trimethoprim oral suspension 10 mg/ml, an empty container of vitamin D tablets, two containers were lidless drinking glasses and one sample was collected in an empty jar of capers.

DISCUSSION

The aim of this study was to investigate if urine samples produced at home by patients who appear unannounced at their GP were of a sufficient quality to meet recommendations for further analysis and diagnosis of suspected UTI.

To the best of the authors knowledge, no prior Danish studies have investigated the pre-analytical aspect of urine sample analysis.

Among the urine samples produced at home, eight (13.3%) met recommendations as they were MSU, delivered in an appropriate container and stored at a cooled temperature until delivery or delivered within ten minutes of urination, which this study defined as immediately. However, if the conclusions by Larocco et al [7] are applied, no significant overgrowth of bacteria is detected in the first four hours after voiding, yielding 21 acceptable samples (35%) as these were MSU, stored in an acceptable container and delivered in less than four hours or stored at a cooled temperature.

The study design has several weaknesses, partly due to the study being conducted at busy GPs with limited research experience. The authors of this study could not minutely oversee the collection of data, which was delegated to receptionists, who often received the urine samples delivered. Despite regular reminders, it is very likely that busyness caused the delivery of the questionnaires to be forgotten. This may have caused the number of included urine samples to be considerably lower than the actual number of unannounced urine samples actually delivered to the three GP clinics. Furthermore, interclinical variations in registration of number of urine samples collected has likely skewed the data, why this study is unfit to report differences between the three clinics. Another weakness is that the study has no information on how many patients or relatives declined to fill in the questionnaire, which may have introduced self-selection bias, as the study may have lost the less proactive patients. Also, it should be noted that anonymous questionnaires are prone to reporting bias, possibly skewing the data in the direction of the recommendations. Furthermore, nine urine samples were delivered by relatives. This carries a risk of introducing incorrect data, given that the relative probably did not observe the micturition. One urine sample was collected in a catheter bag, which almost always shows significant bacteriuria due to colonisation, complicating analysis.

Nine containers were of so unconventional a nature that it might render the analysis of the urine useless. Especially, the urine sample provided in an antibiotic container is astonishing and highlights some of the beneath-the-surface educational challenges physicians face.

Despite the limitations of this study, our findings stress the importance of encouraging patients to produce urine samples at the clinic rather than in their homes. Written or oral instruction at the clinic could plausibly improve the percentage of MSU, while obviously producing an improvement of time to delivery, and ensuring use of an appropriate container.

This study indicates that recommendations for urine analysis in primary care are rarely met, which may lead to falsely positive urine analysis and thereby prescription of antibiotics. As has been observed with antimicrobial resistance in many groups of bacteria, the driver of resistance is usually consumption of antibiotics and thus resistance may likely only be reduced through a reduction of antibiotic consumption.

In line herewith, this study highlights an important aspect of urine analysis in primary care – the pre-analytical setting – and emphasises a crucial objective in the fight against antibiotic resistance.

CONCLUSIONS

The findings of this study suggest that urine samples produced at patients' own home on suspicion of urinary tract infection without first consulting with a general practitioner rarely meet recommendations for further diagnostic analysis.

Further and larger studies are needed to further elucidate this problem along with interventions to improve the rate of urine samples meeting the recommended criteria.

The general practitioner and his or her staff should emphasise the importance of handing in a correctly produced sample when patients appear unannounced with a urine sample and encourage them to produce a new sample in the clinic in line with recommendations.

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