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Evidence-Based Case Report

Association Between Heat Exposure and Urolithiasis

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Abstract

Background
Heat exposure can trigger a person more susceptible to urolithiasis. Urolithiasis can arise due to the concentrated urine concentration thus causing precipitation of crystals. In general, the estimated number of cases of urolithiasis in our society about 10-15%. But in countries like Saudi and other tropical countries, the number of cases could reach 20%. Generally men are more at risk 3-4 fold higher than women. Several studies have suggested heat exposure as a contributor to urolithiasis formation such as cooks, laundry, steel plant, glass plant, drivers, smelter, welder or machinist.

Aim
To determine the relationship between heat exposure and urolithiasis in workers.

Study design
Research studies selected are cohort, cross-sectional and case-control. Patient or population: the workers. Indicator or exposure: temperature/heat environments. Outcome: the formation of urolithiasis

Method and result
Search conducted on 25 September 2013 through PubMed and Google scholar. Through PubMed obtained 18 articles and through google scholar obtained 37 articles. After filtering the corresponding inclusion and exclusion criteria, then obtained 6 articles of cohort studies, cross-sectional and case-control. But the six articles of the screening results, only 1 of the most relevant and appropriate to approach and answer the PICO clinical question, namely research Atan L. et al, entitled "High kidney stone risk in men working in steel industry at Hot Temperatures". In terms of validity, this study is quite valid. A cross sectional study with measurements of the rate of heat conducted qualitatively. In this study there was no follow-up, but the data complete and long enough. Importance valuation studies is illustrated by the value of odds ratio is 9.97, which means that workers exposed to high temperatures have the risk of urolithiasis up to nine times greater than other workers who are not exposed to heat, with a confidence level of 95% CI = 7.38 to 13.47, and $p < 0.0001$, which means significantly. Number needed to harm (NNH) in this study were 14, it means quite dangerous, because it illustrates that every 14 workers exposed to heat, will add one case of urolithiasis exposed.

Conclusion
In this patient, the heat exposure in the working environment will increase the risk of urolithiasis formation in workers, but still lack the evidence to answer the clinical question because only one study obtained and considered relevant. Cross-sectional design is not the best design to prove a causal relationship. For etiologic the best is cohort.

Keywords: EBCR, Cross-sectional, heat exposure, urolithiasis, workers
Illustrative case
A man 30 years old, with a complaint of lower back pain to the left side since 2 months, the pain is intermittent and does not spread. History of hematuria (+), urinary stones out (+), nausea, vomiting fever. The patient had a history of kidney stones left 3 years ago and has been performed ESWL and stone said to be exhausted. Patients' daily work in production dept of Steel Industry since 10 years ago and according to the patient he's working at work environment with hot temperature. From the result of physical examination, laboratory and BNO IVP obtained calix stone left inferior recurrent, the size of 1 cm.

Clinical question
Is the hot temperatures in the working environment affect the formation of urolithiasis at the workers?

Background
Urolithiasis can be caused by many factors. One of these hot temperatures that could trigger a person more susceptible to urolithiasis. Urolithiasis usually arise because of the dense concentration of urine thus causing precipitation of crystals. In general, the estimated number of cases of urolithiasis in our society about 10-15%. But in countries like Saudi and other tropical countries, the number of cases could reach 20%. This is because in the summer someone will produce more sweat, as the summer someone will receive more sunlight. Sunlight is known to contain vitamin D which helps increase the absorption of calcium that can lead to stones. Therefore, by the number of events in the equatorial regions is higher, because people sweat more and high calcium absorption. Urolithiasis can be formed due to calcium, uric acid or infection. Generally men are more at risk 3-4 fold higher than women. 1

Some things that may be risk factors for Urolithiasis is the anatomical differences between men and women, men generally have a longer urinary tract. The composition of the urine, the male urine composition are usually higher calcium and oxalate (its accumulation can cause stones) and low citrate (citrate is known to prevent the stone). Hormonal differences contained both also differ.

1 The composition of the stone that is formed is different.

more calcium stones in men but in women is infection stones. Another factor is in relation to the job, people who work in the field or much exposed to heat such as cooks, laundry, steel plant, glass plant, drivers, smelter, welder or mechanic and lifestyle little motion can increase the risk of urolithiasis 2,3,4

Study design
Selected study design are cohort, cross-sectional and case-control

Patient or population: workers
Indicator or exposure: temperature / heat environments
Outcome: the formation of urolithiasis

Method of literature search
The author did a search on the 25th Sept 2013 through Pubmed and Google scholar. By using the PubMed key words: (urolithiasis OR stone * OR nephrolithiasis) AND (occupation * OR outdoor work) AND (heat OR hot) and via Google Scholar with keywords: urolithiasis, stone, nephrolithiasis, occupation, outdoor work, heat, hot. Both filtering appropriate inclusion and exclusion criteria, such as in the attached diagram 1. Assessing the article using the criteria of the Oxford Center on Evidence-based Medicine that includes assessing validity, importance and applicability as attached in Table 1.

Diagram 1: Chronology literature search

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To determine the validity, importance and applicability of the study was obtained, the criteria used for the study of etiology as can be seen in this table.  

<table>
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<th>Table 1</th>
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<td>Variable</td>
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In the result analysis, it was revealed that 83.1% of workers in the glass industry were exposed to high temperatures. This finding is compatible with the study reported by Borghi et al. who observed a prevalence of 8.5% (n = 236) of urolithiasis among workers in the glass industry (p = 0.03).  

Assessment importance of this study is value Odds ratio is 9.97, which means that workers exposed to high temperatures have the risk of urolithiasis up to nine times greater than other workers who are not exposed to heat, with a confidence level of 95% CI = 7.08 to 13.47, and p < 0.0001, which means significantly. Number needed to harm (NNH) in this study were 14, it means quite dangerous, because it illustrates that every 14 workers exposed to heat, will add one case of urolithiasis.

Overall, this study considered quite good because quite answer clinical questions that determine the magnitude of prevalence.

Discussion

Obtained a study of the most relevant is research Alan L. et al, entitled "High kidney stone risk in men working in steel industry at Hot Temperatures". Judging from relevance, this article is relevant because it fits well in terms of domains, determinants and outcomes in want. This study enough to answer clinical questions that determine the magnitude of prevalence. Importance valuation studies is illustrated by the value of odds ratio was 9.97, and p < 0.0001, which means significantly. The study design was cross-sectional and conducted study in two phases. In this study, a group of workers get a different exposure to the occurrence of urolithiasis. Group 1 works with heat exposure and group 2 works at room temperature. Measurement of exposure assessed qualitatively, not objective using a temperature index and wet bulb (WBGT). Outcome stone is judged through medical records and radiologic examination, and the second phase assessment of metabolic outcomes assessed through evaluation of serum and urine in 24 hours. In a cross-sectional study, risk factors for heat exposure and urolithiasis outputs rated at one moment or one time, 

This finding is compatible with the study reported by Borghi et al. who observed a prevalence of 8.5% (n = 236) of urolithiasis among workers in the glass industry (p = 0.03). For details can be read in table 1.
there was no follow-up, but the cross-sectional study is complete and the data long enough, because it was taken male workers who have worked at least 3 year (March 1999 - Dec 2002).

From the data obtained can be compared between the prevalence of urolithiasis risk group (exposed to heat) with the prevalence of the disease in the group without risk (not exposed to heat). This cross-sectional study is one observational study to determine the relationship between risk factors and disease. In this study, researchers can control the selection of the subject. This study may be the early stages of a cohort study or analytic studies. The advantages of this cross-sectional study is sample size is pretty much at the working population as many as 10,326 people, the design is relatively cheap and fast result. The study also examined several variables and 2 outcomes at once, namely the relationship of heat exposure on the formation of urolithiasis, and hypernatremia low urine volume (p < 0.05). In this cross-sectional study there was no loss to follow-up (drop out).

Another advantage of this study, all workers who participated in this study had no history of previous stone based on medical records and radiological examination. To reduce selection bias, the second phase of the study was conducted at 59 study volunteers were exposed to heat and work at room temperature, but do not have a history of previous stone.

The downside of this is a cross-sectional study does not describe the course of the disease, can not assess the dose-response gradient, is difficult to determine cause and effect between heat exposure with the occurrence of urolithiasis due to the risks and effects of data collection were done at the same time (temporal relationship is unclear). Cross-sectional design is not the best design to prove a causal relationship. For etiologic the best is cohort. However, the relationship between heat exposure with increased risk of urolithiasis can be justified, because the excessive heat exposed workers had a low urine volume. Concentrated urine becomes risk factors for lithogenesis. This finding is comparable with the study reported by Borghi et al. (1993), who observed prevalence of 8.5% (n = 236) of urolithiasis among workers in the glass industry (p = 0.03). Similarly, a study by Ng Tze Pin et al. (1992) in 406 male workers in several outdoor and indoor workers. It turns out the prevalence of urolithiasis in a tropical environment were higher in outdoor than indoor workers (5.2% vs 0.85%, p < 0.05).

In this study, bias can occur due to lack of proper measurement / less sensitive (insensitive measurement bias). Bias can occur in measuring the rate of heat exposure because the measurement is done subjectively only, not measured objectively by using the index and wet bulb temperature (WBGT). It is similar in the 2 pieces of other studies such as study by Luo Haining and Ng Tze Pin et al, which assesses the level of heat exposure is qualitatively based on the type of outdoor works.

To reduce this bias should be increased measurement accuracy of heat stress level, using the index and wet bulb temperature (WBGT). WBGT thermometer consists of dry temperature, natural wet thermometer temperature, the temperature of the thermometer bulb. Method of WBGT tool is installed and placed at the measurement point as high as 1 to 1.25 meters from the floor, placed approximately 50 cm from the heat source and then press the button on. After 20 minutes at each site or the numbers on the monitor is not moving anymore, it can be seen the result is the value of the natural wet temperature, the temperature of dry bulb temperature, wet bulb temperature index (WBGT) for inside and outside the room.

In terms of applicability, the results obtained from the study can be applied in Indonesia because Indonesia is also has a steel mill and some work environments have such hot temperatures, so the potential to experience the same thing, the hot temperature in the working environment can increase the risk of urolithiasis in workers. It is expected that increase fluid intake and administration of potassium citrate may decrease the incidence of urolithiasis.

Benefits of Evidence-based Case Report (EBCR) is to help practitioners improve their skills to apply the results of research (evidence) in daily practice. EBCR provide information to help practitioners in making decisions. Similarly, for the practice of occupational medicine,
EBCR very beneficial in answering clinical questions of patients through research or study results are valid and relevant.

Evidence-based Case Report (EBCR) shows how research results can be applied as in the etiology of this study.

Conclusion
1. In this patient, the heat exposure in the working environment will increase the risk of urolithiasis formation in workers, but still lack the evidence to answer the clinical question because only one study obtained and considered relevant.

2. Cross-sectional design is not the best design to prove a causal relationship. For etiology the best is cohort study.

Suggestion
1. Need a further study in Indonesia in the form of cohort studies can prove a causal relationship between heat stress in the workplace with the formation of urolithiasis.

2. Measurement of heat can be measured objectively through the index and wet bulb temperature (WBGT).

3. To reduce the risk of urolithiasis and hypocratismuria among workers in high-temperature environments, can be prevented by increasing fluid intake and the use of potassium citrate, lemonade eg as a source of citrate.

4. Keep in consideration of a role in the company for metabolic monitoring can prevent urolithiasis in workers exposed to excessive heat.

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