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Complications of Ultrasound-guided Prostate Biopsy

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Abstract: Prostate biopsy is the gold standard for the diagnosis of prostate cancer. Ultrasound-guided prostate biopsy is a routine method for the diagnosis of prostate cancer. At present, the common method is ultrasound-guided transrectal or transperineal biopsy, and fusion MRI can also be used for biopsy. Prostate biopsy brings convenience to clinical diagnosis and treatment, and inevitably brings complications to some patients. However, the incidence of serious complications after prostate biopsy is usually low, but the occurrence of minor complications cannot be ignored.

Keywords: Ultrasound Guidance; Prostate; Puncture Biopsy; Complications.

1. Introduction

Prostate cancer is one of the common malignant tumors in elderly men. The incidence of prostate cancer is the third highest in the United States, and the incidence of prostate cancer in China is increasing year by year [1]. Prostate cancer is the third leading cause of cancer death in men worldwide. Although the detection rate of prostate cancer in China is lower than that in developed countries in Europe and America, in recent years, with the change of economic and living conditions and the acceleration of population aging, the detection rate of prostate cancer in China has shown a significant upward trend [2].By the end of 2020, China 's elderly population aged 60 and over was 260 million, and it is expected to increase by about 10 million people per year from 2021 to 2025 [3]. Prostate biopsy indications include suspicious findings of digital rectal examination, elevated prostate-specific antigen (PSA) levels, and other risk factors such as age. Prostate biopsy is the main way to diagnose prostate cancer. Generally, subjects are well tolerated and have a low risk of complications. However, as an invasive operation, it may lead to the following complications: bleeding, pain, infection, lower urinary tract symptoms and urinary retention, erectile dysfunction and other adverse reactions. The minor complications of bleeding and infection were the most common. Here is to make a brief review of the occurrence of complications after prostate biopsy.

2. General Preparation before Prostate Biopsy

The general preparation before prostate biopsy mainly includes bowel preparation, prophylactic use of antibiotics and whether to clean the biopsy needle after each core sampling. Bowel preparation is mainly used in the transrectal puncture approach to clean the rectal fornix and reduce the bacterial load by removing the feces and bacteria in the rectal mucosa, to reduce the possibility of exposure to intestinal bacteria at the biopsy site. Zhang et al [4] found that the overall infection rate of polyethylene glycol combined with iodine enema was the lowest. In addition, careful postoperative care can also reduce the incidence of complications after biopsy. Preoperative catheterization can also reduce the incidence of postoperative bleeding complications [5].

With the increasing antibiotic resistance in clinical practice, whether prophylactic use of antibiotics has not yet been unified. Basourakos et al [6] believed that there was no significant difference in infectious complications after perineal biopsy in the presence or absence of perioperative antibiotic prophylaxis. However, there is a higher risk of infection in transrectal prostate biopsy, with a total incidence of between 0.1 % and 7 % [7]. Therefore, the prophylactic use of antibiotics before biopsy depends on the choice of biopsy path and the clinician 's assessment of the patient 's health status. Whether to disinfect the biopsy needle during the biopsy, Auffenberg et al [8] believed that the use of 10 % formalin for intraoperative needle disinfection during prostate biopsy can reduce the exposure to bacteria in the prostate, thereby reducing the risk of infection and lower urinary tract symptoms after biopsy.

3. Complications of Prostate Biopsy

3.1. Bleeding

Bleeding is one of the most common complications of prostate biopsy, including hematuria, hematospermia, hematochezia or rectal bleeding. In most cases, the bleeding is mild, self-limited and transient. Bleeding may be related to age, hypertension, the application of anticoagulants and the number of biopsy needles [7]. Pepe et al [9] evaluated the complications after 12-needle, 18-needle and more than 24-needle prostate biopsy. As the number of needles increased, the incidence of bleeding after biopsy increased. Hematuria is the most common bleeding complication [5,9]. Hematuria is also related to the patient 's prostate volume and the presence or absence of other medical complications. Whether enema before biopsy can also affect the occurrence of hematuria.

There is a certain difference in the incidence of hemospermia, ranging from 1.1 % to 93 % [7]. In addition to the different biopsy methods, this difference may also be related to the individual psychological activities of the subjects. As the number of biopsy needles increases, the incidence of hematospermia will also increase [9].

The prostate and surrounding rectal tissue are supplied by a rich vascular network. Compared with transrectal biopsy and transperineal biopsy, the incidence of rectal bleeding after transrectal biopsy is higher [10]. In most transrectal biopsy subjects, rectal bleeding is also transient and self-limiting, and rectal bleeding time greater than 2 days only accounts for 0.7 %

[11]. Massive rectal bleeding after biopsy is rare, but it may be life-threatening. Therefore, in order to prevent and control rectal bleeding, prophylactic use of antibiotics and anticoagulant, antiplatelet and other drugs can be used if necessary. There seems to be no significant difference in the incidence of bleeding complications between MRI-guided prostate biopsy and ultrasound-guided prostate biopsy [12]. In addition, for the surgeon, the bleeding can be temporarily controlled by rectal packing or compression of the puncture site after biopsy.

3.2. Infection

Infection is also one of the common complications after prostate biopsy. Compared with transrectal biopsy, perineal biopsy has a lower incidence of infectious complications [6-7]. Common infectious complications include urinary tract infection, prostatitis, epididymitis, orchitis, systemic infection and so on. The most common pathogen of infection is Gram-negative bacilli, of which Escherichia coli is widely present in the rectum and is also a common cause of infection after transrectal biopsy [7]. Therefore, the preparation before biopsy is very important. Pu et al [13] believed that rectal enema significantly reduced the risk of fever and bacteremia compared with unclean. Pilatz et al [14] thought that rectal cleaning with povidone iodine could significantly reduce the incidence of infectious complications. In addition, the number of biopsy needles, anesthesia, and needle type did not affect the incidence of infectious complications [14].

For the use of antibiotics, with the increasing antibiotic resistance in clinical practice, different subjects have personalized programs. Prophylactic use of antibiotics seems to be necessary for transrectal biopsy. Even with the targeted use of antibiotics, the incidence of sepsis is still 0.64 % [15]. For transperineal biopsy, no prophylactic use of antibiotics may be considered. Spyridon [6] believe that the incidence of sepsis after perineal biopsy is similar with or without the use of antibiotics. Jacewicz et al [16] also believed that after excluding patients with high risk of infection, transperineal biopsy without antibiotics would not increase the incidence of sepsis or urinary tract infection. The commonly used antibiotics are fluoroquinolones, aminoglycosides, cephalosporins and fosfomycins. However, due to increasing resistance, in 2019 the European Commission recommended that fluoroquinolones should not be used prophylactically in prostate biopsies and that indications for perioperative antibiotic prophylaxis should be discontinued [18]. Sepsis after biopsy is a serious manifestation of systemic infection, but the incidence of sepsis is very low, especially transperineal biopsy [6]. The incidence of sepsis after perineal biopsy and transrectal biopsy was only 0.1 % and 0.8 %, both of which were less than 1 % [18].

3.3. Lower Urinary Tract Symptoms and Urinary Retention

Lower urinary tract symptoms refer to the general term of lower urinary tract related symptoms such as frequent urination, urgency, dysuria and incomplete urination. It is reported that about 6 % to 25 % of the subjects will have lower urinary tract symptoms or acute urinary retention after prostate biopsy [7,19], and the incidence after transrectal biopsy is lower than that after transperineal biopsy [20]. The pathophysiological mechanism of urinary dysfunction after biopsy is not clear. It may be related to the iatrogenic injury caused by the invasion of biopsy needle into the prostate, and may also be related to age, narcotic drugs, prostate volume and medical complications [20,21].

Kum et al [21] considered that the factors leading to increased risk of urinary retention were advanced age, larger prostate volume, number of biopsy needles, and more severe lower urinary tract symptoms in patients with diabetes. Compared with elderly patients, young patients have a higher risk of acute urinary retention after biopsy [22]. PSA level and histopathological results were not related to urinary retention. The larger the prostate volume, especially the larger the transition zone volume, the more likely it is to increase the incidence of urinary retention and dysuria after biopsy. This may be related to the anatomical factors of the transition zone adjacent to the urethra. Reducing the number of biopsy needles can reduce the prostate reactive edema and obstruction after biopsy, and reduce the edema of the urinary tract caused by local inflammation. In addition, the occurrence of lower urinary tract symptoms will reduce the quality of life of the subjects, which may lead to social isolation, causing mental health problems and other complications[23]. However, lower urinary tract symptoms and urinary retention are transient, and usually only indwelling catheter or oral α-blockers can relieve symptoms.

3.4. Erectile Dysfunction (ED)

Penile erection is a complex physiological process that occurs through the coordination of nerve, blood vessel, endocrine and psychological activities. Many factors may affect the normal erectile function after biopsy, including age, psychological stress, narcotic drugs, number of biopsy needles, and neurovascular bundle injury[24]. Short-term erectile dysfunction (< 3 months) may be a complication after biopsy, while long-term erectile dysfunction is not related to the biopsy itself [7]. Prostate biopsy is mainly aimed at elderly men. For elderly men, the psychological problems caused by ED after biopsy may be related to psychological factors such as anxiety before biopsy or diagnosis of prostate cancer [25]. It may also be caused by other complications after biopsy. Psychological problems caused by ED symptoms cannot be alleviated or aggravated. Pellegrino et al [26] predicted that the risk of ED will increase with age, and the risk will also increase when there are medical complications. The incidence of ED tends to be higher when nerve block is performed under local anesthesia around the prostate [27].

3.5. Pain

Biopsy as an invasive operation, the occurrence of pain is inevitable. Pain and discomfort are usually caused by rectal probe into the rectum and biopsy needle puncture. Compared with elderly patients, younger patients have more obvious pain after prostate biopsy [22]. The occurrence and degree of pain in transperineal biopsy is much higher than that in transrectal biopsy, and the same is true during anesthesia [11]. This may be related to the distribution of more nerves in the perineum. The use of lidocaine cream as a preoperative rectal and epidermal anesthetic can reduce discomfort during anesthesia. Although most subjects are well tolerated to the biopsy, various methods are still used in practice to reduce the pain and discomfort during the biopsy.

Different anesthesia methods have certain differences in pain during biopsy. He et al [28] believed that the use of perineal nerve block in perineal biopsy was superior to prostate peripheral nerve block in pain relief. The use of

spinal anesthesia, may lead to headache. This may be related to the decrease of cerebrospinal fluid pressure, which causes the meningeal blood vessels and cranial nerves to be pulled, rather than directly caused by the biopsy. Some studies suggest that spinal anesthesia is more effective than other anesthesia [29]. For subjects with pain risk factors, more effective anesthesia methods (such as spinal anesthesia) can be considered. The use of sedatives such as propofol, fentanyl, etc., can also reduce the movement of the subject during the biopsy process, make the biopsy more smoothly, and reduce the pain and discomfort after the biopsy[30]. There are also studies that suggest that the application of music therapy during biopsy can reduce anxiety and relieve pain, but the research and standards in this area are still controversial [31].

In summary, the complications of ultrasound-guided prostate biopsy are mostly mild, and the death caused by complications is rare. Bleeding and infection are common complications after biopsy. Preoperative preparation and postoperative close observation can effectively control the symptoms and prevent their deterioration. Pain is unavoidable in biopsy. Relieving the anxiety and other psychological emotions of the subjects and selecting the appropriate anesthesia method are the concerns of the surgeon. Some subjects may also experience transient lower urinary tract symptoms, urinary retention or ED. In the future, with the development of science and technology, the continuous improvement of ultrasound equipment, anesthesia methods, and preoperative preparation programs, more systematic and comprehensive evaluation and treatment of complications after prostate biopsy, the incidence and deterioration rate of complications after biopsy will be lower.

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