Male patient with prostate cancer biology essay

Science, Biology

Case Scenario: 73 year old male patient with prostate cancerName : Chua Kit YingStudent ID : 200997609‘ I declare that, except where specifically indicated, all work presented in this essay is my own and I am the sole author of all parts.’Prostate cancer is defined as a cancer that develops in the prostate gland. The prostate is an exocrine gland of the male reproductive system. It is being described as a walnut-sized and shaped gland which located underneath the bladder and surrounds the upper part of the urethra that allows urination (Figure 1). The main function of prostate gland is to produce fluid that carries and nourishes sperm called semen. 1 One of the most common problems of prostate is benign prostatic hyperplasia (BPH) whereby there is an enlargement of the prostate gland and can possibly leads to prostate cancer. The enlarged prostate presses on the urethra and causes symptoms known as lower urinary tract symptoms (LUTS), which include increased urinary frequency and urgency especially night time, involuntary urination and dribbling. 2Male urinary systemFigure 1: The position of the prostate3Prostate cancer is the most common cancer diagnosed and the fourth most common cause of death for men in the United Kingdom. Statistically in year 2009, 41 004 men were diagnosed with prostate cancer with approximately 10 000 men died from it in year 2010. 4 Specifically in Scotland, prostate cancer accounts 19% out of all cancers diagnosed in men. It was also recorded by the Scottish Public Health Observatory that 1 in 12 men develop prostate cancer throughout their lifetime. Providentially, the death rate for prostate cancer has decreased approximately 16% over a decade since year 2000. 5Till date, the exact causes of prostate cancer are not yet well understood. However, there are

several risk factors of prostate cancer that have been established. Vitally, age is highly associated with the risk of getting prostate cancer. According to US Surveillance, Epidemiology and End Results Program statistics from 2000 to 2008, there is a approximately a 10 fold increased in incidence of prostate cancer from the age of 40 (92 per 100 000) to age of 70 (984 per 100 000). This indicated that incidence of prostate cancer is progressing gradually with aging. 6 Another risk factor for prostate cancer is ethnicity. A study conducted by Ben-Shlomo Y et al. investigated that in the UK, black Africans has higher chances compared to white men of developing prostate cancer. 7Additionally, a couple of studies have suggested that diet influenced the risk of developing prostate cancer, for example a diet with high fat content, low vegetables and fruits intake increases prostate cancer risk. Conversely, diets high in soy, tomatoes, selenium, and vitamin D have shown a positive effect in lowering the incidence of prostate cancer. Crawford ED observed that soy bean lowers the development of prostate tumour due to the isoflavones content whereby it inhibits cell proliferation. 6, 8 Apart from the above factors, there is a significant evidence that family history is related to the development of prostate cancer. A systemic review done by Johns LE et al indicated that men with family history of prostate cancer have significantly greater risk in developing prostate cancer. 9Essentially, prostate cancer is mainly categorised into four stages (Figure 2). Prostate cancer staging; six panel drawing showing a side view of normal male anatomy and closeup views of Stage I, Stage IIA, Stage IIB, Stage III, and Stage IV showing cancer growing from within the prostate to nearby tissue and then to lymph nodes or other parts of the body. Figure 2: Stages of prostate cancer (stage I to

stage IV)12In stage I, the cancer cells have not spread and found completely in the prostate whereas the cancer is more advanced in stage II, yet the cancer is still remains in the prostate. Stage II is divided in to IIA and IIB. In stage IIA, cancer cells are only found on half or less than one lobe of the prostate and can be detected through needle biopsy whereas in stage IIB, the cancer cells has spread to the opposite side of the prostate and they are unable to be detected during a digital rectal exam or imaging test. Commonly, no symptom can be felt during early stages due to the slow-progressing characteristic of the disease. Initial symptoms such as urinary symptoms which are due to the enlargement of prostate gland can be similar to BPH. 11In stage III, the cancer cells have spread beyond the prostate and infiltrated into the seminal vesicles but not the lymph nodes. Patients will exhibit symptoms like urinary tract infections (UTI), kidney damage, acute urinary retention, blood in the urine, weak and painful urination, erectile dysfunction, less production of semen during ejaculation as well as the formation of bladder stones. 12Lastly in stage IV, the cancer has metastasized beyond the seminal vesicles to nearby lymph nodes or other parts of the body, most common area is the bones (90%), then lungs (46%) or the liver (25%). 13 The most common symptom of metastatic disease is pain at the site of metastases. The intensity of pain increases gradually from dull to constant and intense pain and it is worsen when pressure is applied on the affected area or during physical activities. Long term consequences such as neurological disorders and broken bones due to metastatic cancer can highly influenced the quality of life of the patient. 14Initial diagnosis tests which are commonly used when there is a suspicion of the prostate

cancer are digital rectal examination (DRE), a prostate specific antigen (PSA) blood test and a urine test. A DRE is used to examine the presence of irregular hard lumps or identify any abnormal shape of the prostate. 15 Besides that, a urine test to test the presence of prostate cancer antigen 3 (PCA3) in fluids (e. g. urine) containing prostate cellular materials is used for the diagnosis of the disease. Normally, there is a 60 to 100 fold increase in PCA3 levels in cancerous prostate cells than normal cells. 16 Furthermore, prostate-specific antigen (PSA) test are carried out to determine the PSA level within the blood stream. PSA levels increase with age hence an age-specific PSA reference range (Figure 2) was established which it improves the rate of detection in younger men and eliminate unnecessary biopsy test in older men. 17AgePSA Score (ng/ml)40 - 490 – 2. 550 - 590 – 3. 560 - 690 – 4. 570 - 790 – 6. 5Figure 2: PSA Scores for different age groupsWhen an elevation of PSA level or abnormality of DRE is reported, a biopsy test will be carried out. The prostate biopsy is performed in which tissue sample are taken and examined under the microscope to assess the presence of cancerous cell. If a patient was diagnosed with prostate cancer after a biopsy test, further tests have to be carried out to determine whether the cancer has metastasized to other parts of the body. These tests include an isotope bone scan, chest x-rays, magnetic resonance imaging (MRI) scan, computerised tomography scan (CT) scan and ultrasound scan. 18The National Institute for Health and Clinical Excellence (NICE) 2008 listed the treatment choices recommended for prostate cancer based on the three main stages (localised, locally advanced and metastatic disease). There is no consensus that one treatment is superior over another for the management

of prostate cancer. It is highly dependent on the patient’s preference and disease condition. Currently, the recommended available treatment options for localised prostate cancer includes radical prostatectomy, radiotherapies (e. g. external beam radiotherapy and brachytherapy), and watchful waiting whereas for patients with locally advanced prostate cancer, they are often treated with either radiotherapy or hormone therapy. Lastly, hormone therapy is recommended as the standard first-line therapy for men with metastatic prostate cancer. 19In this case scenario, treatment options for this 73 years old male patient depends on various factors, including his age, past medical history, characteristics of the disease, i. e. whether it is localized, locally advanced or metastatic prostate cancer. Ultimately, the patient himself plays a vital role in the decision making process. Unless the patient was being diagnosed with localised or locally advanced prostate cancer, the first choice treatment should be conservative management (e. g. watchful waiting or active surveillance). According to the World Health Organisation life expectancy data (2009), the average life expectancy for population in the United Kingdom is 80 years old. 20 This indicates that for this 73 years old patient, he has a life expectancy of approximately 7 years. The EAU guidelines on prostate cancer recommended active monitoring to be the most suitable option for patients with a life expectancy lower than 10 years as aggressive therapy and adverse effects are unlikely to extend his life expectancy however might influenced his quality of life. 21 Watchful waiting involves careful monitoring of the clinical progression and constant observing potential symptoms of prostate cancer. On the other hand, active surveillance involves close monitoring of PSA, DRE and possibly repeat

biopsy, with active intervention for patients who develop progression. Lu-Yao et al conducted a trial to observe the clinical outcome of conservative management for localised prostate cancer with participants (n= 14 516) of average age of 78 years old. The study revealed that the rate of survival for 10 year disease-specific in patients under watchful waiting was 94%. 22 In relation with this particular patient, a random trial conducted by Alibhai et al reported that men between 70 and 79 years were most likely to receive no therapy. Chodak GQ et al suggested conservative management to be a viable choice for older men during early stage of prostate cancer. 23 Nonetheless, if this patient chooses conservative approach, he will be advised to have regular PSA test to observe further progression of the disease and determine whether further treatment is needed. Patient also have to understand the risk where the disease may begin to progress during observation as it is not under control by an appropriate treatment. Conversely if patient is not comfortable with the idea of watchful waiting or active surveillance, radiotherapy is a reasonable treatment compared to radical prostatectomy. Crucially however, if this patient appears to be in advanced state of prostate cancer, the quality of life is a crucial factor to consider in choosing the best treatment options. 19 The advantages and disadvantages of each available treatment options should be explained to this patient in order for him to choose appropriate treatments that bring the least influence to his quality of life and normal daily lifestyle. Radiotherapies play a major role in managing prostate cancer. External beam radiation therapy (EBRT) is non-invasive and work by using high energy radiation beams and accelerating protons particles to eliminate the cancerous cells.

Arnold et al reported that when comparing EBRT with prostatectomy, the rate of patients experiencing incontinence and impotence are 3. 5% versus 9. 6% and 61. 5% versus 79. 6% respectively. 24 Hence, patients experienced lesser adverse effects compared to those who undergo prostatectomy. Crucially however, due to the position of the prostate which is close to the rectum (refer to figure 1), rectal complications often developed after ERBT. Even though rectal bleeding is commonly associated after the treatment, severe bleeding is rare and it can be treated by formalin therapy and other measures. 25, 26Another radiotherapy used is brachytherapy (i. e. internal radiotherapy) where tiny radioactive pellets are inplanted into the cancerous tumour. 27 Stock et al reported that patients (n= 1561) with localised prostate cancer who underwent brachytherapy showed a 10 years disease-specific survival rate of 98% and a overall survival rate of 74%. 28 Brachytherapy offers a more localised dose distribution because the pellets are inserted directly in to the prostate when compared to EBRT whereas in comparison with prostatectomy, it has a shorter procedure and shorter recovery time. 26 Essentially, the pellets can be given in a high or low dose manner. Many investigators have suggested the combination of brachytherapy with a small dose of ERBT to achieve a more adequate dose distribution within the prostate gland. However there were no significant benefits reported for this combination therapy. 29, 30Prostatectomy is a surgical process where the entire prostate gland is removed including seminal vesicles, surrounding nerves and veins, and possibly pelvic lymph nodes. Overall, prostatectomy shows enormous benefits to patients by removal of cancer cells. A randomised controlled trial

by Anna BA et al reported that there was a total reduction of 5% and 10% in 10-years mortality rate and metastasis risk respectively when compared to watchful waiting. 31 The disadvantages of radical prostatectomy are the risks and side effects associated such as urinary incontinence, sexual dysfunction and for some patients; it affects the overall quality of life. However, Kao TC and colleagues indicated that 77. 5% of patients are still willing to undergo the surgical procedure again after interviewing 1069 patients who underwent prostatectomy before knowing the side effects associated with it. 32In this case, prostatectomy is not recommended for this patient as men older than 70 years old are not recommended to receive prostatectomy compared to men younger than 65 years of age. 33 Physicians prefer to avoid surgery procedure in older men to prevent adverse effects and post-operative complications including incontinence. 34 Radiotherapy is preferable as it was applied predominantly in patients older than 70 years. 35 However, cure is more likely to happen in low risk patients (i. e. patients in localized state) when using radiotherapies or radical prostatectomy compared to those who are in the high risk disease group. Hence, in this case, patient’s disease state will affect the treatment choices as well as treatment outcome. Hormone therapy appears to be a viable option if the patient was diagnosed with locally advanced or metastatic prostate cancer or patient is unable to cope with radiotherapy due to his state of health. Hormone therapy, also known as androgen deprivation is the standard treatment for patients with metastatic prostate cancer or it may be given to control localised prostate cancer if previous treatment has failed. Hormone therapy act by inhibiting the production or blocking the action of

testosterone in order to inhibit the growth of prostate cancer. 26 This therapy can be given either intravenously or orally. Drugs given as injection or implantation under the skin are called the leuteinizing hormone-releasing hormone (LHRH) agonists which essentially block the production of testerone for example goserelin and leuprorelin. 37 Goserelin (Zoladex) 3. 6mg is administered by subcutaneous injection into anterior abdominal wall every 28 days while leuprorelin 3. 75mg (Prostap® SR) is administered subcutaneously or intramuscularly monthly. 36 Bayaomi AM and colleagues estimated the lifelong cost for a patient associated with LHRH treatment is $27 000 (approximately £16 000). 38 In addition to the expensive cost, side effects induced by the LHRH agonists include sexual dysfunction, hot flushes and sweating, muscle weakness and fatigue. Injection site reactions might occurred as well. 36Oral hormonal therapy is called anti-androgens which include bicalutamide and flutamide that act by blocking the interaction of testosterone with the prostate gland. Bicalutamide (Casomide) is given 150mg once daily whereas flutamide is given 250mg three times daily; both of the drugs are indicated to treat locally advanced prostate cancer. Anti-androgens may lead to complications such as tiredness, osteoporosis, erectile dysfunction, decreased sexual libido and weight gain. If anti-androgens are given for this patient, liver function has to be monitored and herbal remedies or drinking excessive amount of alcohol should be avoided. 36Hormone can be given as monotherapy but it can also be given neo-adjuvantly (i. e. given before treatment) or as an adjuvant hormone therapy (i. e. given following surgery) as well. 26 The usage of hormone therapy with prostatectomy has shown limited benefits. A systematic review of 14 trials

conducted by Shelley MD et al stated that there was no significant difference shown in overall survival when comparing patients receiving neo-adjuvant hormone therapy plus prostatectomy versus prostatectomy alone. 39In contrast, hormones therapy shows improved outcomes when combined with radiotherapy. A randomized controlled trial by Bolla M. et al demonstrated that there was a significant improvement in the 5 years disease survival rate in combined treatment group (79%) compared to the radiotherapy alone group (62%). 40 Subsequently, Widmark et al observed a lower rate of 10-years disease-specific mortality in comparison between the group with combined therapy (11. 9%) and hormone therapy alone (23. 9%). 41 Clinical trial demonstrated that intermittent short term androgen deprivation therapy may improve quality of life and potentially increase survival. It has been theorised that intermittent hormone therapy might have the same benefits as full androgen suppression treatment and cost less. 37 Side effects of hormone therapy include urinary, genitourinary and gastrointestinal problems. Recently, Keating NL and colleagues reported increase insulin resistance and cardiovascular diseases are associated with androgen deprivation treatment. 42Decision making regarding the optimal management for localised, localised advanced or metastatic prostate cancer diagnosed patients especially in elderly men presents a unique challenge. The cancer characteristics and patient’s conditions are a vital component in order to eliminate any unnecessary treatment. Ultimately, the patient plays an important role in deciding the final treatment provided he understands the disease condition, advantages and disadvantages of all treatment options.