Answer 1

1.1 One of the most important concerns from the patient information provided is redness, swelling, and pain along the suture line. These are clear indications of an infection at the surgical site. Pain is an important indicator of infection and the patient's pain score is noted to be 7/10. Additionally, the patient is unable to weight bear and refuses to mobilize due to the pain. Other than that, her temperature is increased to 39.1 ˚C as opposed to normal body temperature of 37 ˚C. These are highly suspicious signs of a bacterial infection at the site and should be confirmed by biochemical testing (Lopez et al., 2017).

1.2 Another abnormal sign is her increased blood glucose level which is 6.8 mmol/L, as opposed to the normal range of 3.9 to 5.5 mmol/L. Her past medical history is not indicative of diabetes, and this must be a new finding. This is concerning because uncontrolled diabetes is an important risk factor for post-operative infections in patients. Several studies have shown that diabetes can lead to higher rates of complications in patients, one of them being prosthetic joint infection (PJI) (Lenguerrand et al., 2018).

Answer 2

2.1 Prosthetic Joint Infection

The introduction of any prosthetic material in the body increases the chance for infection by allowing microorganisms to evade the immune defenses of the body. In the case of PJI, the invading bacteria organize themselves into biofilms along the entire surface of the foreign material. These biofilms are made up of extracellular matrix secreted by the bacteria, which allows them to attach to the surface of the foreign object. Within the biofilm, bacteria are present in a slow growth phase, and there is a depletion of metabolic components and accumulation of waste substances. As the activity of most antimicrobials depends on bacterial growth, bacteria present in these biofilms are not affected by antimicrobial activity (Sukeik and Haddad, 2019).

The bacteria may either enter into the joint cavity directly or they may move into the joint through the bloodstream via hematogeneous spread. Once the bacteria enter into the bloodstream, they may either lead to quiescent bacteremia or clinically significant bacteremia. An important source of entry of bacteria is the oral cavity from where it can move to the joint hematogeneously. Low virulence organisms, such as coagulase negative staphylococci, may lead to low-grade infection and they may only be able to cause infection due to the presence of the prosthetic material. High virulence organisms, such as *Staphylococcus aureus*, can lead to severe septicemia and endocarditis. The bacteria commonly associated with PJI are *Staphylococcus* species, followed by *Streptococcus*, *Enterococcus*, and other Gram negative bacteria (Sukeik and Haddad, 2019).

2.2 Post-operative hyperglycemia

Diabetes mellitus is linked to an increased risk of severe osteoarthritis, and therefore, it is also an important risk factor for total hip replacement surgery. The diagnosis of diabetes increases the risk of a hip replacement surgery by 12.2%. Most importantly, diabetes and the state of glycemic control are also considered to be important risk factors for PJI. Blood glucose variations of greater than 200 mg/dL double the risk of acquiring a PJI. Even without a diagnosis of diabetes, patients are 3 times more likely to develop a PJI if their blood glucose levels are high. The hemoglobin A1c (HbA1c) value is also an important predictor of PJI and values over 7% are an important risk factor for post-operative complications (Eka and Chen, 2015).

This strong association between diabetes and risk of infection may be attributed to lowering of immune system functions, decrease in vascular permeability, reduced redox reactions and oxygen delivery, adherence of neutrophils, phagocytosis of immune cells, intracellular bactericidal activity, and functionality of complement proteins and antibody responses. All these factors can lead to impaired wound healing at the surgical site and predipose a diabetic patient to PJI. Additionally, increased blood glucose levels promote the formation of biofilm at the site of the prosthetic material (Eka and Chen, 2015). Surgical stress can also lead to an increase in blood glucose levels due to the release of certain hormones that antagonize insulin (Alamanda and Springer, 2018).

Answer 3

Problem	Goal	Intervention
1. Prosthetic Joint Infection (PJI)	Eliminate infection, reduce suffering, and restore normal joint function	Implant replacement, where the old prosthetic device is removed and replaced with a new device. This may be done in 2 stages: One-stage where the replacement takes place in a single surgical procedure, and Two-stage, where there is a period of 2 to 8 weeks between the removal of the old device and implantation of the new device (Li et al., 2018).
		Antimicrobial therapy: The choice and dosage of antibiotic will depend on the causative microorganism. The total duration of therapy should be around 12 weeks. In most cases, rifampin and ciprofloxacin are the most effective antibiotics for PJIs (Li et al., 2018).
2. Post-operative Hyperglycemia	Restore blood glucose levels to within the normal range thereby reducing risk of wound infections	Administer basal-bolus subcutaneous insulin, which is useful for non-ICU patients in bringing down the risk and severity of infections. This includes a long-acting basal insulin every day along with a correctional rapid-acting insulin (Gallagher et al., 2017).
		Advise patient to regularly monitor her blood glucose levels and suggest lifestyle changes to minimize the impact of diabetes in her life. Refer to a diabetologist and dietitian to help manage her hyperglycemia (Duggan et al., 2017).

Answer 4

4.1 Interventions for PJI

Surgical replacement of the prosthetic device is considered to be the most important strategy for removing the source of infection. One-stage implant replacement is usually followed in Europe and is ideal for patients with strong bones and soft tissues without a sinus tract. It is usually recommended when the infections are not very difficult

to treat and are not caused by antibiotic-resistant microorganisms. It has a high success rate and can be evaluated by the continuous monitoring of the wound site following the surgery. In contrast, the two-stage process is recommended for patients who have compromised soft tissues and a sinus tract. A duration of 2 to 4 weeks is allowed between the two stages if the causative organism is easily treatable, and a duration of 8 weeks is allowed if the causative organism is unknown and/or difficult to treat. In both the one-stage and the two-stage processes, the rate of reinfection is high, and therefore, the wound site needs to be continually monitored for signs of a relapse (Li et al., 2018).

Antimicrobial therapy is recommended only along with or after the device replacement surgery. It is only administered to the patient in the absence of surgery if there is a high risk for patient life associated with device replacement. In order to select the appropriate antibiotic, swabs from the infection site should be appropriately tested to identify the causative organism and its antimicrobial sensitivity profiles. Based on this information, a suitable combination of antibiotics can be selected for treatment. This therapy can be evaluated by continually monitoring the wound site for a decrease in pain, swelling, and redness (Li et al., 2018).

4.2 Interventions for post-operative hyperglycemia

In many cases of both diabetic and non-diabetic patients who undergo total hip replacement surgeries, there is a high chance of developing post-operative stress-induced hyperglycemia which can lead to an increase in the risk of post-operative wound infections. In order to mitigate this risk, a subcutaneous basal-bolus insulin protocol was devised and is widely used in clinical settings in order to keep blood glucose levels under control. In this strategy, a long-acting basal insulin is administered once daily and a correctional rapid-acting insulin is administered if the blood glucose level is very high (over 180 mg/dl). In cases of post-operative hyperglycemia, it is recommended that blood glucose levels be checked every two hours for continual monitoring of the patient’s hyperglycemia (Gallagher et al., 2017).

Once the infection is controlled and the patient is ready for discharge, it is important to advise the patient regarding the long-term implications of uncontrolled hyperglycemia. She needs to be given an information sheet and recommendations regarding a healthy diet and lifestyle. She also needs to be told the importance of regular check-ups so that a diagnosis of diabetes is prevented and/or controlled, and her quality of life is not hindered to a great extent. Early action on her increased blood glucose level will ensure that diabetes does not become a debilitating disease for her (Duggan et al., 2017).

Answer 5

5.1 Coversyl (5 mg)

Coversyl, also known as perindopril, is an angiotensin converting enzyme (ACE) inhibitor which is used to control hypertension and prevent the risk of a heart attack. It prevents the formation of angiotensin II in the body by inhibiting the action of ACE. This mechanism dilates blood vessels thereby allowing blood to flow more freely through the body. By doing this, it can reduce blood pressure, protect the heart and blood vessels from damage, and prevent the chance of a heart attack or stroke. Apart from this, it also reduces the amount of water that is reabsorbed in the kidneys, thereby lowering the fluid in the blood vessels and further protecting the heart from damage (Buda et al., 2017).

Coversyl is contraindicated in pregnant and breast-feeding women, people with kidney or liver problems, dehydration, atherosclerosis, peripheral arterial disease, collagen vascular disease, cardiomyopathy, and angio-edema. Side effects of this medication include light-headedness, cough, nausea, vomiting, indigestion, diarrhea, constipation, headaches, eyesight problems, tinnitus, muscle cramps, and shortness of breath (Buda et al., 2017). As the patient’s past medical history is significant for hypertension, continuation of this medicine will help keep her blood pressure under control after the surgery.

5.2 Doxepin (25 mg daily)

Doxepin is a tricyclic antidepressant used for the treatment of anxiety, insomnia, and major depressive disorder. The physiological basis of depression comprises of chemical imbalance and decreased level of neurotransmitters in the brain. Doxepin works by increasing the levels of two specific neurotransmitters in the brain, namely serotonin and norepinephrine. Therefore, the availability of these neurotransmitters is prolonged in the synaptic cleft and their neurotransmission is enhanced. Apart from this, it also blocks histamine receptors, muscarinic receptors, and alpha-1 adrenergic receptors, and inhibits potassium and sodium ion channels in cardiomyocytes (Almasi and Meza, 2020).

Based on the receptor that is antagonized, different side effects may be produced by the medication. Blocking histamine receptor may lead to sedation; blocking alpha-1 adrenergic receptors may cause orthostatic hypotension; and blocking muscarinic receptors may lead to dry mouth, dizziness, constipation, and tachycardia. Apart from this, it can also lead to weight gain and, in very rare cases, suicidability. It is contraindicated in people addicted to alcohol and opioids, people taking herbal medications, people taking another class of antidepressants, people having cardiovascular disorders, and breast-feeding women (Almasi and Meza, 2020). Given the patient's history of depression and the fact that it has benefited her for all this time, it is expected to be helpful to her even after her surgery.

Answer 6

One of the biopsychosocial issues that the patient may face upon discharge will be loss of independence, and needing care and attention. Based on the case study, she is a devout Catholic who has been caring for her husband since he suffered a stroke. Now, she has already had complications after her procedure and the thought that there may be nobody to take care of her husband if she suffers severe impairment may affect her physical and emotional health, and lead to increased stress. Studies have shown increased psychological effects related to surgical complications such as distress,

depression, and anxiety especially due to prolonged recovery periods and/or long-term disability or impairment. Patients tend to express depression and hopelessness if their surgical complications are intense. These distressful feelings can further prolong a patients' recovery, delay wound healing, and weaken the patient's immune system. Some of the ways in which psychological distress in a post-surgery patient can be measured include observing activities of daily living, physical activity, and assessing physical health. Apart from this, performance-based measures can also be performed such as evaluation of grip strength, walking capacity, gait, and mobility (Brinson et al., 2016).

References

Alamanda, V. K., & Springer, B. D. (2018). Perioperative and modifiable risk factors FOR Periprosthetic joint Infections (PJI) and recommended guidelines. *Current Reviews in Musculoskeletal Medicine, 11*(3), 325-331. doi:10.1007/s12178-018-9494-z

Almasi, A., & Meza, C. E. (2020). *Doxepin*. Treasure Island, FL: StatPearls Publishing.

Brinson, Z. S., Tang, V. L., & Finlayson, E. (2016). Postoperative functional outcomes in older adults. *Current Surgery Reports, 4*(6). doi:10.1007/s40137-016-0140-7

Buda, V., Andor, M., Petrescu, L., Cristescu, C., Baibata, D., Voicu, M., . . . Tomescu, M. (2017). Perindopril induces TSP-1 expression In hypertensive patients with endothelial dysfunction in chronic treatment. *International Journal of Molecular Sciences, 18*(2), 348. doi:10.3390/ijms18020348

Duggan, E. W., Carlson, K., & Umpierrez, G. E. (2017). Perioperative hyperglycemia MANAGEMENT. *Anesthesiology, 126*(3), 547-560. doi:10.1097/aln.0000000000001515

Eka, A., & Chen, A. F. (2015). Patient-related medical risk factors for periprosthetic joint infection of the hip and knee. *Ann Transl Med, 3*(16), 233rd ser. doi:10.3978/j.issn.2305-5839.2015.09.26

Gallagher, J. M., Erich, R. A., Gattermeyer, R., & Beam, K. K. (2017). Postoperative hyperglycemia can be safely and effectively controlled in Both diabetic AND Nondiabetic patients with use of a SUBCUTANEOUS Insulin Protocol. *JBJS Open Access, 2*(1). doi:10.2106/jbjs.oa.16.00008

Lenguerrand, E., Beswick, A. D., Whitehouse, M. R., Wylde, V., & Blom, A. W. (2018). Outcomes following hip and knee replacement in diabetic versus nondiabetic patients and well versus poorly controlled diabetic patients: A prospective cohort study. *Acta Orthopaedica, 89*(4), 399-405. doi:10.1080/17453674.2018.1473327

Li, C., Renz, N., & Trampuz, A. (2018). Management of Periprosthetic Joint Infection. *Hip & Pelvis, 30*(3), 138. doi:10.5371/hp.2018.30.3.138

Lopez, D., Leach, I., Moore, E., & Norrish, A. (2017). Management of the infected total hip arthroplasty. *Indian Journal of Orthopaedics, 51*(4), 397. doi:10.4103/ortho.ijortho_307_16

Sukeik, M., & Haddad, F. S. (2019). Periprosthetic joint infections after total Hip Replacement: An algorithmic approach. *SICOT-J, 5*, 5. doi:10.1051/sicotj/2019004