INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 14, No. 4, p. 238-247, 2019

RESEARCH PAPER OPEN ACCESS

Assessment of the risk factors and various patient related attributes influencing hemodialysis

Samreen Tanveer[1], Mehran Ashfaq[1], Rashida Parveen[1], Kanwal Ashiq[1*], Mehwish Qayyum[1], Mayyda Bajwa[1], Sana Ashiq[2], Afshan Arshad[3]

[1]*Faculty of Pharmaceutical Sciences, Superior University 17-km Raiwind Road Lahore, Pakistan*

[2]*Sharif Medical and Dental College Lahore, Pakistan*

[3]*Department of Allied Health Sciences, Superior University 17-km Raiwind Road Lahore, Pakistan*

Key words: Hemodialysis, Renal failure, Intradialytic complications, Quality of life, Kidney transplant.

http://dx.doi.org/10.12692/ijb/14.4.238-247 Article published on April15, 2019

Abstract

Renal failure is associated with a variety of comorbid conditions and negatively affects the patients' quality of life. The aim of current study was to assess various patient related attributes effecting on the efficiency of hemodialysis accompanied by vital parameters such as predominant cause of end stage renal disease, intradialytic complications, determination of diet plan impact on hemodialytic patients and analysis of hemodialysis as only treatment of choice in renal failure except kidney transplant. Data of 50 patients were collected from Sheikh Zayed hospital dialysis unit. Statistical analysis was done by SPSS version 22. About 40% patients presented a family history of renal disorders, 70% patients undertook peritoneal dialysis prior to hemodialysis, A-V fistula at lower arm was most recommended location for vascular access, 10% patients used heparin during hemodialysis, 60% patients were on iron and vitamin intake, 80% patients were on limited intake of sodium and fluid, 76% patients were taking potassium and calcium supplements and 80% patients were taking albumin and proteins. About 96% patients were taking Eprex injection and 80% patients were vaccinated. Joint pain and muscular weakness were major complications and 60% patients showed intension of kidney transplant to improve their quality of life. Hereditary factors, diet, fluid intake and lack of awareness play a key role in the incidence of renal failure. If awareness of renal disorders and hemodialysis amongst population could be developed then early diagnosis and better treatment of renal failure will be done along with improvement in the patient's quality of life.

* **Corresponding Author:**Kanwal Ashiq ✉ kanwal.ashiq@superior.edu.pk

Introduction

Hemodialysis is considered a cleansing process in which a dialysate similar in composition as blood plasma is used to remove waste products from blood (Carter *et al.,* 2000). The incidence of renal failure is associated with a variety of comorbid conditions like hypertension, diabetes and other cardiovascular diseases (Ritz *et al.,* 1999). It is reported that in young blacks there is an increase rate of end stage renal disease (ESRD) due to diabetes, hypertension and renovascular diseases. The survival rate of ESRD has been improved due to gradual improvements in hemodialytic complications (Foley and Collins, 2007). Hypertension is one of the major factors that lead to renal failure (Wright Jr *et al.,* 2002). Anabolic steroids are considered a secondary cause of renal failure especially in athletes and bodybuilders (Herlitz *et al.,* 2010). Although survival rate has been remarkably increased due to hemodialysis, there are certain complications which arise during hemodialytic procedures including cardiovascular and non-cardiovascular complications. Reasons of the cardiovascular complications are increased arterial stiffness and decreased diastolic blood pressure (Blacher *et al.,* 1998). There is a significant association between nutritional status and hemodialysis efficiency (Qureshi *et al.,* 2002). Major causes of mortality during hemodialysis are hypertension and other cardiovascular diseases, old age, diabetes, infection and malnutrition (Brunner and Selwood, 1992).

In renal failure and hemodialysis, the vitamin balance get disturbed and it may lead to metabolic disorders. However, the use of antibiotics and other agents in hemodialysis to treat infections due to impairment of immune response may also exaggerate hypovitaminosis. These antibiotics also cause the termination of vitamin producing intestinal flora (Kosmadakis *et al.,* 2014). It is suggested that peritoneal dialysis should be done prior to hemodialysis. This is because, in the initial stages of treatment, complete information of the patient disease profile is not available. So, it is safer to undergo peritoneal dialysis during the first two years of dialysis treatment prior to the patient's transfer to hemodialysis (Heaf *et al.,* 2002). Serum albumin level plays an important role in hemodialytic procedures as it is a predictor of nutritional status. Nutritional state of the patient can be determined by body weight, plasma insulin and serum albumin levels. Studies have shown that a low albumin level is associated with an increased death rate (Ikizler *et al.,* 1994).

Vaccination prior to hemodialysis is necessary because the immune system gets weaker in chronic renal failure. Patients on hemodialysis show impaired vaccination response against various infections (Krüger *et al.,* 2001). Data provided in another study has elaborated the significance of vaccination in long term hemodialysis. Findings showed the efficiency of influenza vaccines and support annual vaccination in hemodailytic patients (Scharpé *et al.,* 2009).

Location of fistula is also very important regarding patient's comfort and efficacy of hemodialysis. Bay W.H and coworkers surveyed staff members including dialysis unit nurses, surgeons, technicians and nephrologists regarding their preference in hemodialysis vascular access. This survey showed that A-V fistula was the most preferred access for hemodialysis (Bay *et al.,* 1998).

The preferred treatment for end stage renal disease patients is kidney transplantation. Hemodialysis is a temporary treatment. Several studies were conducted to determine which dialysis method is best for ESRD patients (Fenton *et al.,* 1997). In the United States, hemodialysis is the preferred therapy for end stage renal disease patients. Dialytic technology has greatly extended the life span of ESRD patients (Block *et al.,* 2004). Renal transplant is considered as most satisfactory and promising treatment for renal failure patients. Patients who have undergone renal transplant experience an improvement in quality of life (both physical and social activities) as compared to the patients on hemodialysis (Fujisawa *et al.,* 2000). However, some studies showed that patients who suffered from failed kidney transplant undergoing hemodialysis developed chronic inflammation, erythropoietin resistance and worsened anemia (López-Gómez *et al.,* 2004).

The aim of present study was to assess various patient related attributes effecting on the efficiency of hemodialysis accompanied by vital parameters such as predominant cause of end stage renal disease, intradialytic complications, determination of diet plan impact on hemodialytic patients and analysis of hemodialysis as only treatment of choice in renal failure except kidney transplant.

Material and methods

Data were collected from the fifty patients with end stage renal disease undergoing hemodialysis in Sheikh Zayed Hospital, Lahore. It was a retrospective study in which direct questions were asked from the patients. A questionnaire was developed to gather the data about hemodialysis. Questions regarding history, medications, causes, vaccination, heparin usage, frequency of hemodialysis and Intradialytic complications were asked. Statistical analysis was done by using SPSS version 22.

Results and discussion

Results of duration of hemodialysis have shown (Fig. 1) that 30% patients were on hemodialysis up to 10 years, 50% patients undergoing hemodialysis up to 5 years and 20% were on hemodialysis for 2 years or less. Family history of renal failure has exhibited (Fig. 2) that 40% patients have a family history of renal failure whereas 60% have no family history.

Studies also indicated that hereditary factors play important role in the incidence of renal failure (Freedman *et al.,* 1993). Peritoneal dialysis before hemodialysis results have illustrated in Fig. 3. Approximately, 70% of the patients have undergone peritoneal dialysis prior to hemodialysis as this has more survival advantages due to low incidence of co-occurring disorders (Murphy *et al.,* 2000). It is suggested that peritoneal dialysis should be done prior to hemodialysis.

This is because at the beginning of the treatment complete information about patient disease condition is not available (Heaf *et al.,* 2002).

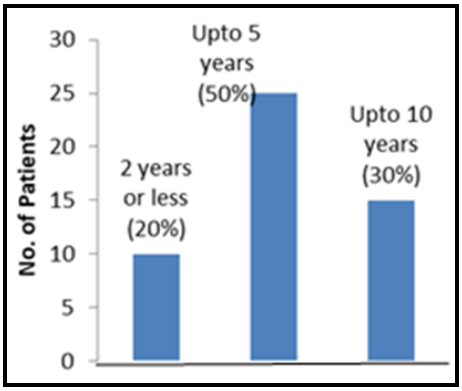

Fig. 1. Duration of hemodialysis.

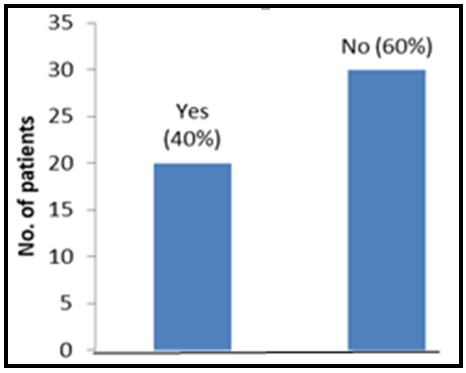

Fig. 2. Family history of renal failure.

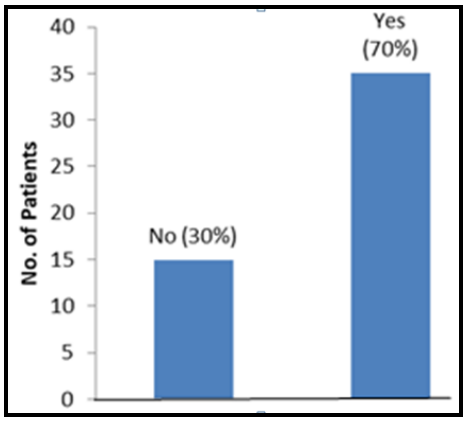

Fig. 3. Peritoneal dialysis before hemodialysis.

There are various factors which are responsible for renal failure. Causes of renal failure are shown in Fig. 4, about 50% have diabetes, 40% are associated with hypertension and 10% of the patients have a history of using the steroids. According to some studies, survival rate of renal impaired patients having diabetes are remarkably low (Ritz *et al.,* 1999).

Many studies have suggested different mechanisms and hypotheses regarding glucose mediated renal damage which include over production of free radicals by mitochondria in hyperglycemic situations

and activation of growth factors present in the kidney due to high levels of glucose (Brownlee, 2001). In 40% of the patients leading cause of renal failure was hypertension. Studies have also reported that hypertension as one of the major factors associated with renal failure (Wright Jr *et al.,* 2002). Furthermore, in 10% of patients steroids contributed largely in the progression of renal failure.

The reason for this progress could be due to increase in body mass and nephrotoxic effects of anabolic steroids (Herlitz *et al.,* 2010). Frequency of dialysis per week results has showed that the 60% patients have undergone hemodialysis twice a week, whereas 40% have gone through hemodialysis thrice a week (Fig. 5).

Conventional hemodialysis is preferred over frequent hemodialysis (frequency of hemodialysis is 5 to 6 times per week) as the later may lead to many complications such as vascular access interventions, imbalance of albumin level, patient depression and cost intensive treatment (Group, 2010).

Results of Heparin used during hemodialysis have demonstrated that 10% patients used heparin during hemodialysis whereas 90% did not use heparin during hemodialysis (Fig. 6). Heparin is used in hemodialysis to prevent clot formation.

Some studies suggested the use of lower effective dosage of heparin than unfractionated heparin as this leads to reduction in excessive bleeding in hemorrhagic complications (Lai *et al.,* 1996).

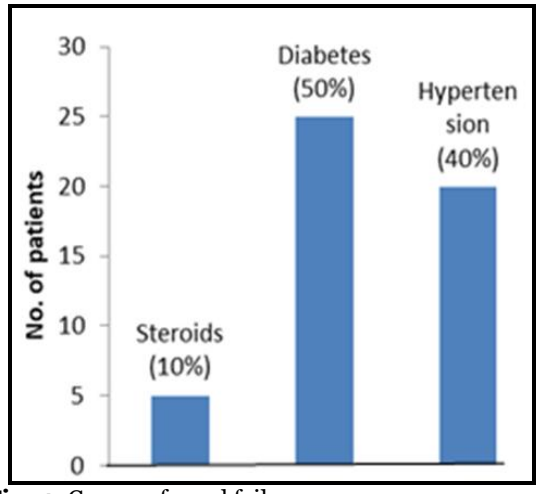

Fig. 4. Causes of renal failure.

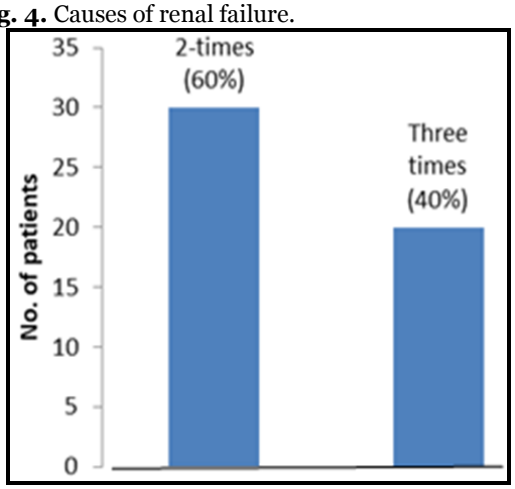

Fig. 5. Frequency of dialysis per week.

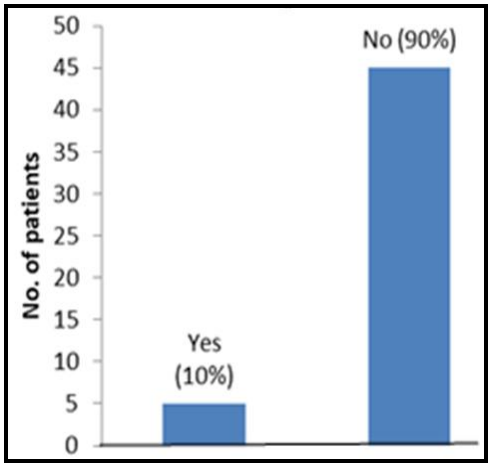

Fig. 6. Heparin used during hemodialysis.

In current research as only 10% patients used heparin while 90% patients did not use any anti-coagulants is may be due to increased risk of prolonged bleeding and clotting time after removal of dialysis needles (Cronin and Reilly, 2010). Location of fistula results (Fig. 7) have exhibited that in 76% patients' fistula were located on lower arm, in 16% patients on

forearm and in 8% patients location of the fistula was on jugular vein. A-V fistula at lower arm is the most recommended location by nephrologists though On the contrary patients prefer forearm vascular access (Bay *et al.,* 1998). Moreover Jugular vein is recommended as temporary vascular access (Fenton *et al.,* 1997). Folic acid, iron and vitamin intake results (Fig. 8) have shown that 60% patients were taking iron, folic acid and vitamins whereas 40% were not taking these supplements. The use of iron is necessary for erythropoietin activity. So, oral ferrous sulfate and intravenous dextran injections are given to compensate iron deficiency. Intake of antioxidant vitamins is also necessary because hemodialysis may generate reactive oxygen species that may lead to vascular disorders.

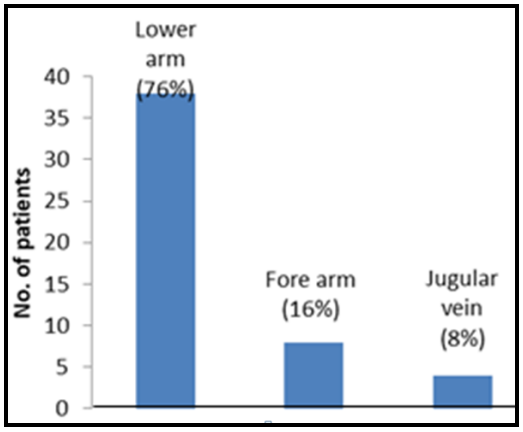

Fig. 7. Location of fistula.

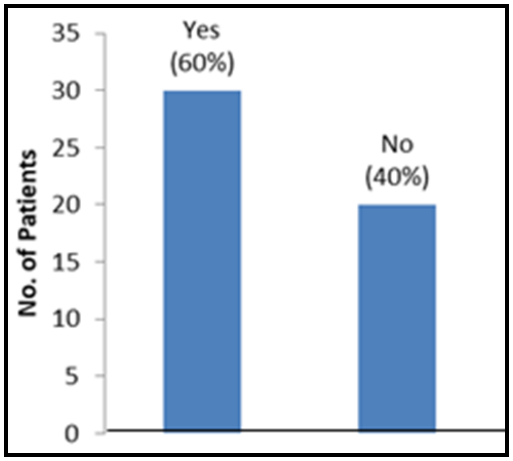

Fig. 8. Folic acid, iron and vitamin intake.

Deficiencies of vitamin C and B complex were particularly reported in patients with renal pathology (Snyder *et al.,* 2004). End stage renal disease (ESRD) is characterized with electrolyte imbalance. That's why potassium and calcium supplements are given to patients on hemodialysis. About 76% of patients were taking limited intake whereas 24% of patients were taking excessive intake of potassium and calcium (Fig. 9). Hyperkalemia is considered as most fatal condition for hemodialytic patients, according to new research hypokalemia is equally fatal and it's responsible for mortality in hemodialytic patients. Hypokalemia occurs due to malnutrition, medications or diarrhea (Choi and Ha, 2013). But calcium supplements are commonly use in hemodialysis as increase concentration of calcium combat Intradialytic hypotension (Maynard *et al.,* 1986). Results of the fluid and sodium intake (Fig. 10) have demonstrated that 80% of patients taking limited intake whereas 20% of patients taking excessive intake of fluid and sodium. Sodium and fluid intake is necessary because hyponatremia occurs in patients on hemodialysis and according to studies lower serum concentration of sodium and fluid lead to patient death (Waika *et al.*, 2011). Protein and albumin intake(Fig.11) have suggested that 80% of patients taking albumin whereas 20% of patients were not taking protein and albumin. During hemodialysis there was a marked decrease in the serum levels of amino acids and proteins.

This decline in concentration of amino acids and proteins may be associated with malnutrition or anorexia. Loss of amino acids and albumin during hemodialysis, using larger pore size membranes, has also been reported by various studies so it is essential for hemodialytic patients to take albumin and protein rich diet (Ikizler *et al.*, 1994).

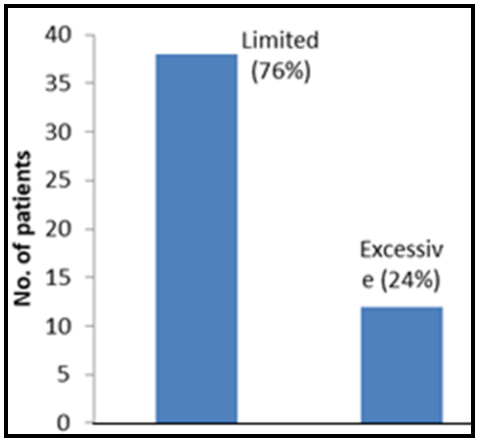

Fig. 9. Potassium and calcium intake.

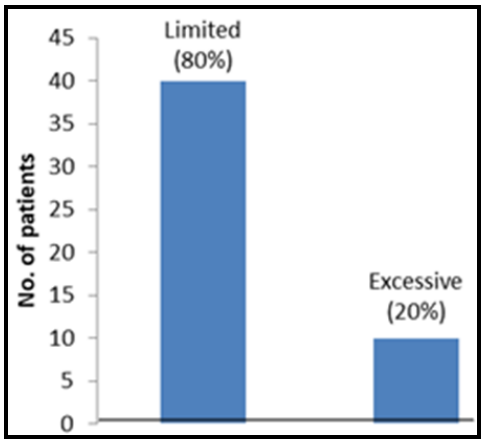

Fig. 10. Fluid and sodium intake.

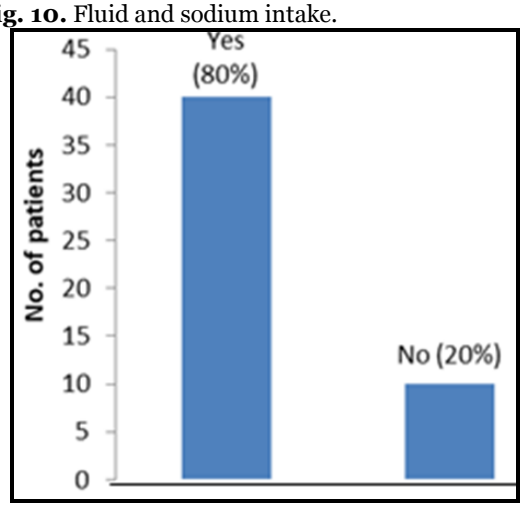

Fig. 11. Protein and albumin intake.

Medication accompanying hemodialysis exhibited that 80% of patients were taking medicines whereas 20% of patients were not taking medicines accompanying hemodialysis (Fig. 12). Data about the injection Eprex given for blood deficiency has exhibited (Fig. 13) that 96% of patients received Eprex injection for blood deficiency whereas 4% of patients did not receive Eprex injection. These include medicines for hypertension and oral anticoagulants. Most common side effect that arises during hemodialysis is anemia because in renal failure kidneys fail to secrete hormone "erythropoietin" (Snyder *et al.,* 2004) and for this reason synthetic erythropoietin is given through injections to patients on hemodialysis.

In present study 96% of patients were taking Eprex injection (alfaepoetina, 4000UI/0,4ml) to manage their hemoglobin level. Now a day's recombinant human erythropoietin is also used for the management of anemia (Fishbane and Berns, 2005).

Renal failure is characterized with impairment of immune system. So, patients of renal failure need to be vaccinated prior to hemodialysis against various infections like tetanus, diphtheria, hepatitis etc. Hemodialysis is considered as reservoir of hepatitis as it is transmitted through blood transfusion not only to patients but also to staff members (Krüger *et al.,* 2001). The current study showed that almost 80% patients were vaccinated prior to hemodialysis as shown in Fig. 14. However, it was indicated that 20% patients showed symptoms of muscular weakness and vomiting while 30% of patients complained about joint pain, 14% presented symptoms of hypotension whereas 10% and 6% of patients had symptoms of hepatitis and stomach upset respectively as shown in Fig. 15. High incidence of hepatitis during hemodialysis is mainly due to blood transfusion procedures. Hepatitis virus is not only transmitted to patients but practitioners are also at high risk (Alter *et al.,* 1986). Preventive measures should be done either by isolating hepatitis patients or through vaccination (Stevens *et al.,* 1984).

Muscular weakness particularly in extremities occurs due to decrease blood pressure, decrease blood volume and disturbances in electrolyte balance. About 14% of patients showed complain of hypotension during hemodialysis due to weight loss, trauma, bleeding disorders and use of antihypertensive medicines. Approximately 20% of patients suffer from nausea and vomiting during hemodialysis due to

decrease in blood pressure and disequilibrium syndrome. Arthritis is considered as most common complication in hemodialysis.

Shoulders, hips and wrist are most commonly affected joints accompanied with stiffness and pain (Kleinman and Coburn, 1989) and affects negatively on quality of life (Kanwal *et al.,* 2017). In addition to the above mentioned complications gastrointestinal irregularities were also commonly reported in patients on hemodialysis. These include abdominal pain, irritable bowel syndrome, constipation and diarrhea. Gastric dilatation due to intestinal pseudo obstruction was also reported during hemodialysis in some studies (Shinoda *et al.,* 1989). Nearly 40% of patients showed the intentions of renal transplantation (Fig. 16), as the renal transplantation is most promising treatment for renal failure (Simmons *et al.,* 1984). However, 60% of patients were not interested and did not prefer renal transplantation as just in case of failure of renal transplantations severe complications were observed like chronic inflammation, infection, anemia etc. (López-Gómez *et al.,* 2004) which ultimately changed the patient's choice of treatment.

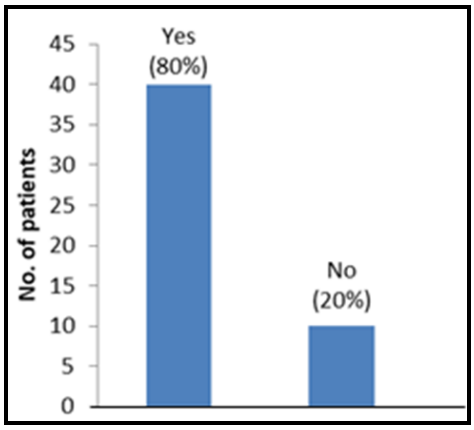

Fig. 12. Medication accompanying hemodialysis.

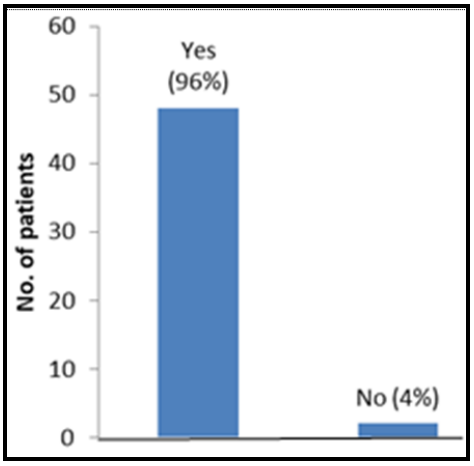

Fig. 13. Injection Eprex given for blood deficiency.

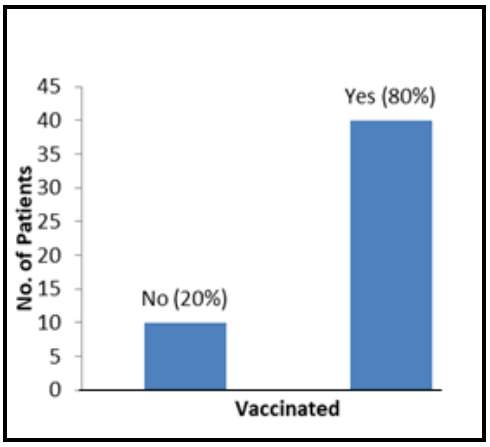

Fig. 14. Vaccinated patients.

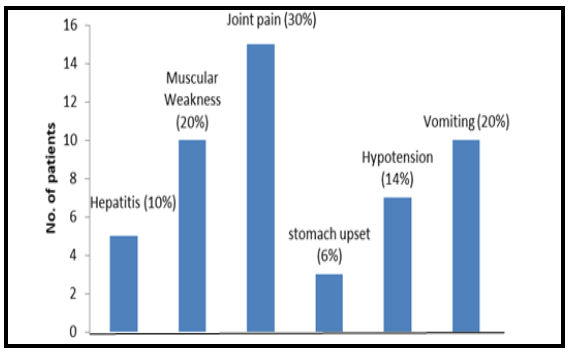

Fig. 15. Complications associated with hemodialysis.

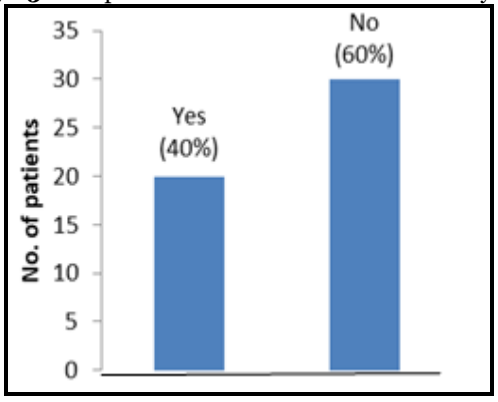

Fig. 16. Intensions for kidney transplantation.

Conclusion

Renal failure is associated with a variety of comorbid conditions. Hereditary factors, diet, fluid intake and awareness play key role in high incidence of renal failure. It is beneficial to undergo peritoneal dialysis in initial stages of the therapy prior to hemodialysis. Furthermore Iron, vitamins, potassium, calcium, sodium and fluid intake are also recommended in hemodialysis depending upon renal status of individual patients. It is suggested that there is still need to develop awareness regarding renal disorders and hemodialysis amongst the population so that prior diagnosis of renal failure and early intervention of kidney malfunction could be done along with improvement in the patients' quality of life.

Acknowledgement

We are very thankful to Sheikh Zayed Hospital administration, Chief pharmacist and to all doctors and nurses for allowing conducting current study.

Conflict of interest

There is no conflict of interest among authors.

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