ABSTRACT
Chronic Kidney Disease (CKD) is becoming one of the major public health problems. Incidence of CKD is doubled in last fifteen years. CKD is under diagnosed and undertreated. The treatment cost is high and outcome is poor. In India, only 10% of patients with end stage renal disease (ESRD) have access to renal replacement therapy. Therefore action plan should be early detection of CKD by screening high risk patients with hypertension, diabetes, Obesity, Nephrotic syndrome and stone diseases. Once the diagnosis of CKD is established, determine the underlying cause, rule out reversible causes like obstruction, dehydration, infection and malignant hypertension. Stage the CKD according to estimated GFR from serum creatinine. During stage 1 and 2, the focus should be on treatment of cause, comorbidities, addressing reduction of cardiovascular risk factors and instituting measures to slow the progression of CKD. During these early stages aggressive blood pressure control, diabetes control and reduction of proteinuria are mainstay of therapy. In stage 3 in addition to continuing measure described the focus shift to evaluating and treating complications of CKD such as anemia, malnutrition, mineral bone disease, hypertension, acidosis, volume overload and overall health. By stage 4 preparation for renal replacement therapy (RRT) (dialysis& transplant), creation of vascular access and patient education should begin. When stage 5 is reached or symptoms of uremic syndrome ensue renal replacement therapy is started. Stage 5 –stage of Kidney failure need optimized Pre-dialysis care to improve dialysis and transplantation outcome. Early referral to nephrologist in stage 4 or one year in advance of requirement of RRT is associated with better outcome.

INTRODUCTION
Chronic Kidney Disease (CKD) is one of the major global health problem. CKD is becoming increasingly common due to rising incidence of diabetes, hypertension, obesity and ageing population in India. The approximate prevalence of CKD is 800 per million population and incidence of end stage renal disease (ESRD) is 150-200 per million population.¹ Prevalence reported based on community survey in Chennai south India was 0.86% in 2005.² Modi and Jha reported from urban population in city of Bhopal that the crude age adjusted incidence rates of ESRD were 151 and 232 per million population respectively.³ Once the patients develop CKD progress to ESRD and require renal replacement therapy but many of them die of non-renal causes particularly premature cardiovascular events. Early detection and management of risk factors like tight glycemic control, good blood pressure control, correction of dyslipidaemia, reduction of proteinuria with use of ACE/ARB can retard progression and reduce cardiovascular events. Optimal pre-dialysis care improve morbidity, mortality, dialysis and transplantation outcome. Main aim of this review is to describe optimal pre-dialysis action plan. Goal of this action plan is 1] To establish diagnosis.2] Rule out reversible causes 3] Slow down progression 4] Evaluate and treat complications5] Treat co-morbidities 6] Reduce cardiovascular risk.7] Prepare for replacement therapy.8] Select and start renal replacement therapy at appropriate time.

WHAT IS CHRONIC KIDNEY DISEASE? (CKD)
Definition
The US NKF-DOQI (National Kidney Federation- Kidney Dialysis Outcomes Quality Initiative)⁴
Chronic Kidney Disease- Pre-Dialysis Management: The Action Plan

Table 1: Classification and Clinical Action Plan for CKD

<table>
<thead>
<tr>
<th>Stage</th>
<th>eGFR ml/min/1.73m²</th>
<th>Description</th>
<th>Action plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>≥ 90 ml</td>
<td>At increased risk of CKD</td>
<td>Screening for CKD risk reduction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Hypertension</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Diabetes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Obesity</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>≥ 90 ml</td>
<td>Kidney damage with normal renal function</td>
<td>Establish diagnosis of CKD, treat underlying disease, Retarding progression</td>
</tr>
<tr>
<td>2</td>
<td>60-89</td>
<td>Kidney damage with mild ↓ renal function</td>
<td>Control of BP, Control of DM, Proteinuria Reduction, Cardiovascular risk reduction</td>
</tr>
<tr>
<td>3</td>
<td>30-59</td>
<td>Moderate ↓GFR 3A</td>
<td>Above + Monitor GFR three monthly</td>
</tr>
<tr>
<td></td>
<td>50-45</td>
<td>Moderate ↓GFR 3B</td>
<td>Avoid Nephrotoxic drugs, Prescribe antiproteinuric drugs, (ACE &amp;/or ARB)</td>
</tr>
<tr>
<td></td>
<td>44-30</td>
<td>Moderate ↓GFR 3B</td>
<td>Evaluate and treat complications, Adjust drug doses</td>
</tr>
<tr>
<td>4</td>
<td>15-29</td>
<td>Stage 4 CKD Severe ↓ kidney function</td>
<td>Above + Preparation for renal replacement therapy, Consider indications to refer to Nephrologist</td>
</tr>
<tr>
<td>5</td>
<td>&lt; 15</td>
<td>Stage of Kidney failure D:- Dialysis T:- Transplant</td>
<td>Above + Consider to start RRT(dialysis, transplant), Pre-emptive transplant or Palliative care</td>
</tr>
</tbody>
</table>

Guidelines define CKD as:- Glomerular Filtration Rate (GFR) less than ≤ 60ml/min/1.73m² that is present for ≥ 3 months with or without evidence of kidney damage or evidence of kidney damage with or without decreased GFR that is present for ≥ 3 months as evidence by microalbuminuria, proteinuria, glomerular haematuria, pathological abnormalities (e.g. abnormal biopsy), anatomical abnormalities (e.g. scarring seen on imaging or polycystic kidneys). It is important to remember patient with GFR ≥ 60ml/min/1.73m² without kidney damage is not considered as CKD. The two formulae are commonly used are one developed by Cockcroft and Gault. The other derived from the modification of diet in renal disease (MDRD) study, K-DOQI recommends MDRD formula to estimate GFR from serum creatinine. This formula is not validated below age 18 years; rapidly changing GFR. MDRD equation tends to underestimate normal renal function. It is only validated in Caucasian and blacks though probably acceptable for use in south Asians. It is only an estimate (Confidence interval are wide, 90% of patients will have a GFR with 30% of their normal). Thought standardization of creatinine assays remains an issue, the KDOQI staging system provides a useful frame work for the management of CKD. The KDOQI guidelines have classified CKD into 5 stages. In 2005 KDIGO, The kidney disease improving global outcome group suggested clarifications including the addition of ‘T’ for patient with renal allograft and D to identify CKD stage 5 patients on dialysis. The UK national Institution of Health and Clinical Excellence (NICE) has modified in 2008, the KDOQI CKD classification by subdividing CKD stage 3 into 3A and 3B, estimated GFR of 45-59 ml/min/1.73m² and 30-44ml/min/1.7m² respectively. The NICE CKD guidelines also stipulated that the suffix p be added to the stages in proteinuric patients. Table 1 shows different stages and action plan.

CKD Management Stage 1 and 2 (eGFR ≥ 60ml/min/1.73m²)

GOALS OF STAGE 1-2 CKD MANAGEMENT

- Establish or confirm a diagnosis.
- Rule out any potentially treatable or reversible etiologies.
- Retard / Delay progression.
- Reduce cardiovascular risk.

It is very important to rule out potentially reversible etiologies such as dehydration infection, obstruction and rapidly progressive glomerulonephritis which can be treated to prevent CKD. The specific cause of CKD may have systemic or other organ specific effect or require disease specific treatment or may affect pre and post- transplant management. CKD patients with diabetes DM may not necessarily be the cause of CKD, rule out non-diabetic glomerular diseases.

ESTIMATING AND RETARDING / SLOWING PROGRESSION OF DISEASE

Once CKD is established it tends to progress. Studies in experimental animal and human suggest that progression in CKD is more often due to secondary factors that are unrelated to the activity of the initial disease. The major risk factors are thought to be intraglomerular hypertension and glomerular hypertrophy leading to glomerular scarring. There is much diversity in progression. The decline in GFR may vary from 2ml/min/1.7m² to 24ml/min/1.7m² with mean 12ml/min/1.7m² per year. The progression depends on the original disease and progression factors. Diabetes nephropathy and other glomerular diseases tend to progress more rapidly than tubulo-interstitial disease and nephrosclerosis. Modifiable risk factors for progression, treatment of which are able to retard progression are hypertension, proteinuria, hyperlipidemia, obesity and smoking. Hyperphosphatemia and hyperuricemia are emerging progression factors that need more randomized...
controls trials for confirmation.9 Besides pharmacotherapy, dietary counseling for appropriate restriction in salt, protein, saturated and trans fatty acids, nicotine, advanced glycation end products, phosphate additive, purines and fructose is important but often unappreciated tool for renoprotection.8 The NKF-K/DOQI guidelines for CKD state that “There is insufficient evidence to recommend for or against routine prescription of dietary protein restriction for the purpose of slowing the progression of CKD.1 The largest randomized controlled trial performed to date the modification of diet in renal disease (MDRD) study showed overall little benefit in patients with moderate and advanced renal failure (GFR ≤ 25 ml/min/1.73 m²). However subsequent meta-analyses suggested may be some benefits.11 Individual decision making is recommended after discussion of risk and benefit.11 There is clear evidence in diabetic nephropathy and non-diabetic chronic kidney diseases that the administration of angiotensin converting enzyme (ACE) inhibitors or angiotensin II receptor blockers (ARBs) slows the progression of chronic kidney disease, with the greatest benefit in patients with higher degrees of proteinuria.12 Table 2 summarizes the measure that will retards the progression. Persistent adherence to treatment of these factors also helps to reduce a cardiovascular risk and preserve residual renal function in patient on dialysis.

CARDIOVASCULAR RISK REDUCTION

The Presence of CKD is one of the most potent known risk factor for cardiovascular disease. Mortality and morbidity due to cardiovascular disease are substantial in CKD stage 4 and Stage 5 patients. Individuals with CKD have a 10-20 folds risk of cardiac death than age and sex match control without CKD. Patients with CKD are at least 20 times more likely to die from cardiovascular disease than survive to need dialysis or transplant.

Traditional risk factors including old age male gender, family history, hypertension, DM, dyslipidaemia, smoking, physical inactivity are common among CKD patients. In addition, many factors related to uremic state like anemia positive, salt balance, hyperphosphatemia, secondary hyperparathyroidism, Vitamin D deficiency, acidosis, hyperuricemia, accumulation of asymmetrical diethyl arginine (ADMA), Advance glycation end products (AGEs) and triglycerides contribute to high risk of cardiovascular disease. All these factors culminate in a syndrome of chronic inflammation due to oxidative stress and endothelial dysfunction. Inflammation may contribute to atherosclerosis, Arteriosclerosis, Vascular calcifications, Insulin resistance.

Therefore to prevent cardiovascular disease in CKD traditional as well as non-traditional risk factors should be targeted. Life style modification, cessation of smoking, weight reduction, low salt diet, physical exercise, moderate alcohol consumption, are successful in reducing overall cardiovascular risk. Aggressive control of blood pressure, achieving glycemic control, treating dyslipidemia retards the progression as well as reduce cardiovascular risk. Inhibitors of the rennин angiotensin aldosterone system, statin and aspirin are advocated to reduce the inflammatory response cardiovascular risk in CKD.

DETECTING AND MANAGING COMPLICATIONS OF CKD

A wide range of complications begins to occur the GFR falls below 60ml/min/1.7m². These include disorders of fluid and electrolyte balance such as volume, overload, hyperkalaemia, metabolic acidosis, hyperphosphataemia, secondary hyperparathyroidism, bone disease, hypertension, anaemia, malnutrition, atherosclerosis and cardiovascular complications. These complications can be prevented or delayed by early detection and treatment.

Hypertension

Hypertension is both a cause and a complication of CKD. The risks of uncontrolled hypertension include progression of

### Table 2: Progression Factors Management

<table>
<thead>
<tr>
<th>Factor</th>
<th>Target</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Pressure</td>
<td>&lt; 130/80 mm of Hg</td>
<td>Life style modification</td>
</tr>
<tr>
<td></td>
<td>&lt; 125/75mm of Hg if proteinuria ≥ 1gm/24hrs.</td>
<td>Salt restriction - Exercise</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ACEI and/or ARB - First like diuretics - Calcium blockers</td>
</tr>
<tr>
<td>Proteinuria</td>
<td>&lt; 1gm/day</td>
<td>Salt and protein restriction</td>
</tr>
<tr>
<td></td>
<td>&gt; 50% reduction of baseline value</td>
<td>Stop smoking, ACEI/ARB first line</td>
</tr>
<tr>
<td>Obesity</td>
<td>BMI ≤ 25 ≥ 18 kg/m²</td>
<td>Life style modification</td>
</tr>
<tr>
<td></td>
<td>Waist ≤ 90 cms in Male</td>
<td>• Restriction of calories</td>
</tr>
<tr>
<td></td>
<td>≤ 80 cms in Females</td>
<td>• Increased physical activities</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>LDL cholesterol ≤ 70mg/day</td>
<td>Dietary advice statins</td>
</tr>
<tr>
<td></td>
<td>Triglycerides ≤ 150 mg/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HDL ≥ 40 mg/day</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>0 cigarettes</td>
<td>Ask, Advice, Assess, assistance</td>
</tr>
<tr>
<td>Hyperglycemia</td>
<td>HBA1C &lt; 7%</td>
<td>Life style modification</td>
</tr>
<tr>
<td>Hyperphosphataemia</td>
<td>3.5 – 4.5 mg/dl</td>
<td>Phosphate restriction/Phosphate binder</td>
</tr>
<tr>
<td>Hyperuricemia</td>
<td>S. uric acid ≤ 7.0 mg/dl</td>
<td>Purine fructose restriction</td>
</tr>
<tr>
<td>Acidosis</td>
<td>Serum bicarbonate ≥ 22 mEq/L</td>
<td>Sodium Bicarbonate</td>
</tr>
<tr>
<td></td>
<td>Avoid Nephrotoxins</td>
<td>Treat underlying acute disease, relive obstruction</td>
</tr>
</tbody>
</table>
kidney disease and increased risk of coronary heart disease, left ventricular hypertrophy, cardiac failure, and stroke. Hypertension is present in approximately 80 to 85 percent of patients with CKD.

Management

Target BP<130/80 mm of hg or 125/75 mm of Hg if proteinuria ≥ 1gm per 24 hrs or if diabetes present.

Therapy: What Drug?

Nonpharmacological therapy includes, lifestyle modification, salt restriction, physical exercise to reduce weight, maintain ideal body weight, limit alcohol intake to no more than two standard drinks per day (Men) and 1 standard drink per day (Women). Stops smoking and follow dietary advice.

Multiple medications often three or more drugs will be needed to control hypertension adequately in most patients with CKD. Patients with diabetes and proteinuria should be treated with an ACE inhibitor or ARB as first line therapy. When treatment with an ACE inhibitor or ARB is initiated, monitoring of serum creatinine and potassium is recommended on day 3 and 7 and weekly. If acute rise in creatinine is less than 30% above the base line and stabilizes within 2 months. The medication should be continued. People whose creatinine rises are most likely to achieve the greatest benefit in terms of renal protection. If the rise in serum creatinine is greater than 30% above base line value the medication should be stopped and person is investigated to rule out bilateral renal artery stenosis. If serum potassium concentration is greater than 6.0mEq/l despite dose reduction, diuretic and dietary therapy. The medication including spironolactone should also be stopped. Diuretic should be used in most patients both loop diuretics and thiazide diuretics are effective adjunct antihypertensive therapy. Additional agents can be chosen based on cardiovascular indications. Beta blockers, Atenolol, bisoprolol may be useful in patients with coronary artery heart disease, tachyarrhythmias and heart failure, Carvedilol, alpha and beta blockers also can be used. Calcium channel blocker nifedipine, amlodipine may be added if BP is not controlled. It may also preferred in patients with systolic hypertension, hypertension in elderly. If blood pressure target is still not achieved, alpha blockers prazosin, doxazosin followed by direct vascular smooth relaxant minoxidil is considered.

Anaemia

Anaemia is constant feature in many patients with CKD. As CKD progresses incidence of anaemia increases. Anaemia most common and treatable complication of CKD. Anaemia is caused by insufficient Erythropoietin production, shortened life span of RBCs, iron deficiency, systemic inflammation, and secondary hyperparathyroidism. The anemia of CKD is typically normochromic and normocytic.

Management

Target Hb: 10-12 gms% Avoid rapid correction & Hb over 13gm%

Workup should be initiated when the haemoglobin is less than 12gm/dl in male and < 11gm/dl in female. Exclude other forms of anaemia. First correct iron deficiency target S. ferritin >200mg/ml and transferrin saturation >20% NKF guidelines suggest that EPO should be given initially of dose of 80/120 units per kg per wk. Administered subcutaneously11. Although Erythropoietin has traditionally been given in 2 or 3 doses per week. It is currently commonly given only once per week. Most patients receive 10,000 units s.c. Once a week as starting dose.7 If necessary subsequent adjustments made in interval and or dose, Haemoglobin testing is recommended weekly. Dose adjustment is usually done on monthly basis. The goal is to achieve target haemoglobin over 2 to 4 months. Darbepoetin alfa is the newer alternative to Erythropoietin. It is long acting agent having long life. The recommended starting dose in CKD is 0.45ug/kg S.C. once a week. It is also found effective in pre-dialysis patients administered once every other week at a dose of 60 mcg.7

Correction of anemia with erythropoietin improves quality of life, reduce cardiovascular morbidity, regression of left ventricular hypertrophy, Improve sexual, cognitive function and prevent recurrent hospital admissions in CKD.

Mineral and Bone Disorders

As kidney function decreases phosphate retention occur due to reduction in filtered phosphate load. High phosphate load hypocalcaemia stimulate the parathyroid hormone secretion, leading to secondary hyperparathyroidism which increases bone resorption. As CKD progress less active 1,25 dihydroxy vitamin D is produce. Decreased 1,25 dihydroxy vitamin D can cause both a low serum calcium level and high PTH. These changes of high phosphate, low calcium and high PTH are associated with abnormal bone metabolism, increased risk of fracture, increased cardiovascular morbidity and accelerated vascular calcification.

Management

Dietary phosphate restriction may limit the development of secondary hyperparathyroidism. An intake of about 800mg/day may be desirable and is recommended by the K/DOQI guidelines in patients with elevated phosphate and or PTH levels.14 Once GFR falls below 25-30 ml/in, the addition of oral phosphate binders are usually require to prevent hyperparathyroidism. The K/DOQI guidelines recommended Serum phosphorus levels should be between 2.7 and 4.6 mg/dl among patients with stage 3 and 4 CKD and between 3.5 and 5.5 mg/dl among those with stage 5 CKD. The calcium phosphorus product should also be maintained at ≤ 55mg. The target for PTH is also close to normal in patients up to
stage 3 CKD and Stage 5 target PTH is 3-6 times upper limit of normal. Phosphate binders are most effective if taken with meal to bind dietary phosphate. It should not be taken at the same time as iron supplement aluminum hydroxide is prototype binder and remains the most effective. Aluminium toxicity restricts its use (less than 4 weeks). The decision as to which class of binder to use initially is based on the starting phosphate level and the calcium-phosphorus product. When the serum phosphate level is higher than 7 mg/dL or the calcium-phosphorus product is higher than 63 mg²/dL², the initial choice should be a non-calcium-containing binder. Calcium containing phosphate binder (CCPB) have been the mainstay, not only bind PO₄, but help to correct hypocalcaemia and suppress PTH. Patients receiving calcium containing phosphate binders are in positive calcium balance. CCPBS have therefore been implicated as a cause of vascular calcification and adverse cardiovascular outcome. CCPBS should ideally be restricted to 1500mg elemental calcium per day. They should be avoided if low turn over disease. Non-calcium, non-aluminum containing binder e.g. sevelamer bicarbonate and lanthanum carbonate allow calcium and aluminum to be avoided. Both are extremely expensive and no more effective than CCPBs efficacy in preventing CV morbidity and mortality is unproven. Sevelamer may lead to less hypocalcaemia and is associated with slower progress of coronary calcification. Sevelamer lowers LDL cholesterol may provide additional CV risk modification. Lanthanum carbonate is also expensive long term consequences of administration is unknown (No toxicity in short term studies) role in clinical practice not yet established.

**Treatment of secondary hyperparathyroidism in pre-dialysis patients.**

First control serum phosphate. Vit D or vitamin D analogues should be given to treat secondary hyperparathyroidism. The CKD stage-specific target levels of intact PTH are 1) CKD stage 3: treat elevated PTH to target 35-70pg/ml.2) CKD stage 4 to target 70-110 pg/ml.3) CKD stage 5 to target 150-300 pg/ml. Once the PTH level is established, the next step is assessment of 25-(OH)D levels and replacement with vitamin D₃ (ergocalciferol) if levels are lower than 30 ng/mL. If the intact PTH level is elevated and the serum 25-(OH)D level is higher than 30 ng/mL, treatment with an active form of vitamin D is indicated. Available options are calcitriol, alfacalcidol, or doxercalciferol. During vitamin D therapy, serum calcium and phosphorus levels need to be monitored closely to prevent hypercalcemia and hyperphosphatemia, aiming for levels lower than 10.2 mg/dL and lower than 4.6 mg/dL, respectively. Calcimimetics are agents that increase the sensitivity of the calcium-sensing receptor in the parathyroid gland to calcium. The only available medication in this category is cinacalcet which can be used if elevated serum phosphorus or calcium levels limit the use of vitamin D analogues. Although not approved for patients with CKD not yet on dialysis cinacalcet, the only currently available calcimimetic is an emerging option in the treatment of secondary hyperparathyroidism in predialysis patients with CKD.

**SODIUM AND WATER IMBALANCE**

Sodium and intravascular volume balance are usually well maintained until CKD stage 5. This is caused by an increase in the functional excretion of salt and water by remaining nephrons. However the ability to respond to rapid infusions of sodium with volume expansion will be reduced even in CKD stage 3 and 4 making them prone to fluid overload. Patient with fluid overload will respond to dietary sodium restriction and loop diuretics. The optimal level of daily salt intake varies from patient to patient. Less than 6 g/day of sodium chloride (<2 g/day of sodium) is the typical initial recommendation. Adjustments need to be made depending on the patient's volume status, aiming to achieve normotension and only trace pedal edema. As CKD progress to stage 4 and 5 ability to concentrate and dilute urine is impaired and urine becomes isothionic. Therefore patients are at risk for development of hypo or hypernatremia caused by positive of negative water balance respectively. Free water intake should be approximately equal to urine output plus 500ml for insensible losses. Some investigators have also claimed that limiting sodium intake may also help to retard progression by lowering intraglomerular pressure.

**POTASSIUM IMBALANCE**

**Hyperkalaemia**

Hyperkalaemia is common and potentially fatal problem occurring in advanced stage of CKD especially oliguric patients with GFR less than 10ml/min/1.73m². Other factors like high potassium diet, ACEI/ARB. Spironolactone NSAID therapy and increased tissue breakdown also may contribute to the development of hyperkalaemia. Rapid rises in K⁺ are generally more dangerous than gradual ones, as cell membrane stability is more vulnerable to acute changes.

Dietary restriction is main stage in management of chronic hyperkalaemia If it persists the next step is the addition of loop diuretic to promote kaliuresis by increasing sodium delivery to the distal nephron. If acidosis is present sodium bicarbonate is helpful by increasing distal nephron sodium delivery inducing kaliuresis and promoting intracellular potassium shift. An additional alternative is the use of potassium binding resins such as sodium or calcium polystyrene sulfonate combined with sorbitol to avoid constipation, at smaller doses than those typically used for the treatment of acute hyperkalaemia given daily or every other day. Fludrocortisones in dose of 0.1 to 0.3 mg/day may be useful in treating chronic hyperkalaemia in patients with hypoaldosteronism with or without hyporeninism and patients with ESRD undergoing hemodialysis who have interdialytic hyperkalaemia. There are several measures that should taken to prevent hyperkalaemia in CKD such as,
Low potassium diet (Less than 40-70 mEq/day) avoiding no steroidal anti-inflammatory drug, ACEI/ARB, spironolactone and non selective beta-blockers. Refractory hyperkalaemia may indicate the need for dialysis.

**Metabolic Acidosis**

The metabolic acidosis usually occurs in advance renal failure. This is mainly due to decrease ability to regenerate bicarbonate, reduced ammonia production, decrease hydrogen ion secretion, decrease filtration of titrable acids – sulphate, phosphate, urate, hippurates and decrease proximal tubular re-absorption of bicarbonate. In early stages acidosis is non-anion gap acidosis but as CKD progress it becomes high anion gap acidosis. Serum bicarbonate stabilizes between 12-20 mEq/Lit and rarely falls below 10 mEq/Lit. There are three major reasons why treatment of academia may be desirable in patients with CKD are 1) Bicarbonate supplementation may slow the progression of CKD. 2) Bone buffering of some of the excess hydrogen ion is associated with the release of calcium and phosphate from bone, contributing to worsening of renal osteodystrophy 3) Uremia acidosis can increase skeletal muscle breakdown and diminish albumin synthesis leading to loss of lean body mass and muscles weakness – contributing to malnutrition. Therapy is targeted to maintain serum bicarbonate concentration above 23 mEq/Lit. The drug of choice is sodium bicarbonate less than 0.5-1.0 mEq/kg/day. Sodium citrate (citrate is converted into bicarbonate in body) is generally better tolerated than bicarbonate but should be restricted to patients who are not taking aluminum containing phosphate binder because it enhances intestinal aluminum absorption.

**PREPARATION FOR RENAL REPLACEMENT THERAPY**

Patients with progression CKD require preparation for RRT dialysis or transplant or comprehensive clinical care. Creating and implementing these care plans is multidisciplinary team approach. Patients with CKD should be referred to a Nephrologist early in the course of their disease preferably before the creatinine concentration exceeds 1.2 and 1.5 mg/dl in women and men respectively or the eGFR is less than 60ml/min /1.73m². These subspecialties are trained to help counsel the patient in choosing the optimal renal replacement therapy and to manage the many issues associated with CKD. Lower cost and or decreased morbidity and mortality may be associated with early referral and care by subspecialist. Once it is determined that RRT will eventually be required the patient should be counseled to consider the advantages and disadvantages of hemodialysis (In centre or at home). Peritoneal dialysis (continuous or intermittent modalities), and renal transplantation (Living or deceased donor). Kidney transplantation is the treatment of choice for. A successful kidney transplant improves the quality of life and mortality risk for most patients, Lower cost when compared with maintenance dialysis. If potential living donor is available goal should be pre-emptive transplant. i.e. transplant prior to dialysis. Such patients appear to have improved graft survival compared to those who undergo a period of dialysis before transplantation. If patient is not a candidate for transplant, vascular access, should created preferably native arteriovenous fistula in CKD stage 4 i.e. GFR less than 25ml/ min. The 2006 K/DOQI guidelines recommend that a fistula be placed at least six months prior to the anticipated start of haemodialysis. Venous preservation should start from CKD stage 2-3 itself. All CKD patients should be vaccinated against Hepatitis B infection as early as possible during course of CKD. As uremia sets in seroconversion rates decreases. In addition, there are recommendations to vaccinate patients with CKD against pneumococcal and influenza infection. Patients with advance CKD have an increased risk of drug related side effects. Dosage of drugs should be adjusted according eGFR. Patients with CKD are high risk for contrast induced nephropathy. Which should be prevented by either avoiding, using minimal possible, non-ionic, iso-osmolar contrast and hydration with normal saline and administration of acetylcysteine. MRI using linear gadolinium contrast agents has been associated with severe nephrogenic systemic fibrosis and should be avoided in pre-dialysis CKD stage 3, 4, 5 patients.

There are guidelines that advocate early screening for patients at risk of CKD. The detection of patients with early disease may also be facilitating proper care and early referral to nephrologist. The K/DOQI clinical practice guidelines and action plan can be accessed through national Kidney Foundations. Web site at www.kidney.org/professional /KDOQI/guideline.cfm.

**SUMMARY**

CKD incidence is increasing. Once CKD is diagnosed it is destined to progress to ESRD. Cost of treatment, morbidity and mortality is high. Aim is to detect, evaluate and diagnose CKD early and refer to nephrologists. Classification of CKD into stages 1 to 5 facilities patient care through the applications of disease specific clinical action plans. During early stages, aggressive blood pressure control and decreasing proteinuria with use of ACEI/ARB have been found effective in retarding progression to ESRD. Management of CKD includes 1] Treatment of reversible causes of renal dysfunction such as hypovolemia, infection, obstruction, primary active disease, malignant hypertension. 2] Slowing progression 3] Reducing cardiovascular events managing risk factors. 4] Treatment of complications.5] preparation for renal replacement (dialysis and transplant) therapy.

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