PREVENTION OF DIABETIC NEPHROPATHY.

Sanjiv Saxena (From CAPENEWS issue # 1, January 1997)

Renal disease, a debilitating microvascular complication of IDDM, is defined as presence of persistent proteinuria in a diabetic with concomitant retinopathy and elevated blood pressure, in the absence of UTI, other renal disease or heart failure. With better management, more and more IDDM patients are living to adulthood, so this long term complication is being seen more often, even though many diabetics still continue to succumb to other complications like DKA or infections. Peak incidence of nephropathy is after 20-25 years of onset of diabetes. The majority of those who have proteinuria develop end stage renal disease (ESRD) in the next 6-10 years. Development of nephropathy is a bad sign because these diabetics also have a higher chance of ischemic heart disease (IHD). So proteinuria is also a marker of hypertension and IHD. Why should a pediatrician bother about this and other chronic complications of IDDM? The reasons for this lie in recent research, including the DCCT and other studies, which show that
a. proteinuria and nephropathy can be postponed/ reduced by good glycemic control
b. that the early phase of sub-clinical nephropathy can be reversed by improving glycemic control.

Therefore the seeds of chronic complications are laid in the patterns of glycemic control and self-care behavior in the first few years of diabetes diagnosis. The pediatrician can do a great deal to change the dismal scenario.

PHASES OF DIABETIC NEPHROPATHY:

The early phase of nephropathy are marked by a higher GFR, with no abnormality in urine analysis. With good glycemic control, GFR returns to normal. In the next phase, termed incipient nephropathy, there is an increase in urine albumin excretion though clinical overt proteinuria is absent. This abnormal increased excretion can be picked up by screening periodically for microalbuminuria: by radioimmunoassay or recently developed strip tests (specifically for microalbuminuria), using a timed urine sample. Microalbuminuria results vary from day to day, so abnormal results should be confirmed by repeat testing. Persistent microalbuminuria has been shown to be a risk factor for development of overt nephropathy, as well as retinopathy, hypertension and later IHD. The clinical phase of diabetic nephropathy is diagnosed once overt proteinuria (>500mg/day) appears, which can be detected using a conventional dipstick for urine protein. This stage is marked by inexorable progression towards ESRD.

PREVENTION AND THE ROLE OF THE PEDIATRICIAN:

The DCCT has shown that diabetics with an HbA1c of 7% had a 50% reduction in incidence of nephropathy, compared to those with HbA1c of > 9%. Similar reduction in progression from micro- to macroalbuminuria was seen in the two groups. Therefore, it is mandatory for the pediatrician to try for best possible glycemic control from the time the child is diagnosed as having diabetes. This can be achieved by regular diet/ exercise/ insulin regimens, with ongoing adjustments based on home monitoring of blood glucose, and confirmed by quarterly measurement of glycated hemoglobin. A team approach with a pediatric diabetologist, nurse educator, dietician, and others as relevant, is necessary for optimal management. Blood pressure should be measured at least once a year, especially during adolescence. High protein diet should not be consumed (advise normal protein sufficient for growth). Urine microalbumin excretion should be measured in a 24 hour (or overnight 12 hour) urine collection at initial evaluation (baseline), and annually or bi-annually later. One must not forget that diabetics are more prone to severe UTI, so a routine urine exam should also be done simultaneously, and whenever symptoms of UTI appear.
If high blood glucose is found in a child or adolescent, the diagnosis is almost invariably insulin dependent diabetes. With increasing awareness and access to better medical care, children with IDDM are now surviving longer, so the prevalence appears to be rising. Several studies have shown that diabetes patient education and better metabolic control improve the quality of life, reduce the frequency of acute complications, and help prevent chronic complications. This has now been provided firm evidence by the DCCT (diabetes control and complications trial). It is critical for the pediatrician to provide proper guidance to diabetic children and their families, since what they are taught in the first few months after diagnosis will determine the quality (and the length) of the rest of their lives. The reason for this is that the ideas and concepts they learn early are very difficult to unlearn later.

Perhaps the greatest advance made in the past decade in the management of IDDM is that ongoing monitoring has become possible, and its importance realized. Monitoring must consist of:

1. **Clinical examination**: The doctor must check the weight, height, and blood pressure of the child at least 2-3 times a year. The child with poor glycemic control may be underweight and short (underinsulinized) or overweight (overinsulinized), while normal growth and pubertal development can be expected in the well controlled diabetic. Insulin injection sites should be checked 2-4 times a year and proper site rotation ensured, though with the availability of human insulins and improved syringes such as BD, problems of hypertrophy and pain are much less. A baseline fundus examination should be done at or soon after diagnosis, and then annually after puberty.

2. **Blood glucose (BG)**: should be tested at home, by the parents/child, at least 1-2 times per day. It is impossible to ensure good metabolic control on the basis of periodic fasting and post-prandial lab tests. Improved test-strips and lancets for pricking (the new 28G Ultrafine lancets are particularly good) are now freely available all over India, so blood can be easily drawn and reasonably accurately tested. The tests should be done before breakfast, before lunch, before dinner and at bedtime, with a full profile 2-3 times a week. The values should be recorded systematically in a small diary and this log brought on each clinical visit, when the patterns and adjustment measures should be discussed. The target range of pre-meal BG in older children should be 80-140mg%, with looser targets in those under the age of 5 years. BG should also be tested occasionally in the middle of the night, i.e. about 2-3 am (1-2 a month). This is very important in detecting and preventing night-time hypoglycemia.

Doing and recording BG tests as outlined above allows the child and family to ensure control round the clock, see the effect of insulin, diet and exercise, make adjustments when needed, and get feedback on what they are doing. The log lets the doctor check if the family is managing correctly, and provide guidance for errors. Algorithms are available: a modified version of the one used at the Diabetes Of Young: DOY: Clinic at AIIMS, is appended. Used intelligently, the BG log may give the diabetic more information and help than the best dietician or doctor available!

A frequent objection raised is that home monitoring is too expensive for diabetics in India. What is not realized is that not monitoring is even more expensive! Even in the short run, self testing and adjusting can help prevent many hospital visits, school/ work absences, and episodes of severe hypoglycemia and ketoacidosis, allowing the child to lead a more normal life (studies and play). In the long run, good control is essential to keep chronic complications at bay. Cost-cutting measures such as using half-strips and visual tests (without a meter), can bring monitoring within the reach of those in the lower income ranges. We found in the DOY clinic at AIIMS that with proper explanation and ongoing motivation, over 65% diabetics (including those from the low income groups) were willing and able to monitor regularly.

3. **Urine tests: Ketones** should be checked once a week in the first pass urine, to ensure night hypoglycemia is not occurring. Also ketones should be looked for if BG is high consistently (2-3 values >300 mg/dL), indicating the need for increasing the dose of insulin.
Urine glucose is too unreliable an indicator of BG, to be depended on for regulating control. However, if BG tests cannot be afforded at all, urine tests are better than no testing. Second voided urine should be tested; first void urine is useless as it reflects blood glucose over the previous many hours. Timed urine collections can be tested for glucose excretion to give a broad idea of glycemic control.

4. Self-care skills: e.g. handling insulin (loading, injecting, storing, during travel), self testing of blood/urine, self adjusting, should be reviewed at least annually, to check for errors/misconceptions.

5. Glycosylated hemoglobin: gives an idea of the average blood glucose status over the preceding 8-10 weeks, and so is a must for assessing the quality of glycemic control in all diabetics. In those with IDDM, it should be tested every 3-4 months. It gives an overall confirmation of home monitoring of BG, and is a useful predictor of chronic complications. The aim should be to keep it 1-1.5 points above the non-diabetic range.

6. Tests for chronic complications: The development of tests for microalbumin excretion (Micral strips: less expensive, accurate; RIA or ELISA) make detection of renal damage possible at the reversible stage. The test is best done after ensuring that there is no urinary tract infection, in a timed urine collection (12 or 24 hours), as baseline soon after diagnosis, and then annually after puberty. The diabetic child is more prone to have dyslipidemia and hypothyroidism. Therefore, serum cholesterol, triglyceride and TSH levels should be checked at diagnosis or the first visit, and then every 1-2 years thereafter.

The diabetic child/adolescent and family need huge inputs of time and expertise for basic and ongoing education and motivation. It may not be possible for the busy pediatrician or physician to devote so much time to a single patient. Therefore to optimize care it is best to coordinate with a pediatric diabetologist or team specializing in the care of such children. This team work and economic liberalization mean good control is possible for young diabetics, changing them from being poorly controlled, miserable, frequently ill, and at risk of renal failure or blindness in middle age to bright, confident, well controlled youngsters, who can look forward to normal personal and professional lives.

INSULIN TREATMENT ALGORITHM

Basic Premises:
1. Morning REGULAR insulin has major action between breakfast and lunch: effect reflected in blood/urine test before lunch (BL).
2. Morning LENTE insulin provides BG control for the rest of the day, and to some extent at night: major effect reflected in test before dinner (BD).
3. Evening REG. insulin has major action after dinner: effect reflected in test at bedtime (BT)
4. Evening LENTE insulin provides blood sugar control for the rest of the night: major effect reflected in the next morning's fasting test (before breakfast: BBF).
5. There is no illness/situation altering insulin requirement.
6. BG testing is regular (1-2 profiles of BBF, BL, BD, BT per week) and performed properly.
7. No changes are to be made till a pattern forms: 3 BG high or 2 BG low at a particular time.
8. Changes should be one at a time, small (10%, maximum 20% if BG is very high) and smooth.
9. Earliest BG tackled first: e.g. first BBF corrected, then BL (if needed), then BD (if needed)...
*If BD sugars are low 2 tests in a row, from day 4 decrease morning lente by 2 U
*If BT sugars are low 2 tests in a row, from day 4 decrease night plain by 1 U

_______________________________________________________________________

INSULIN SUPPLEMENTS: In contrast to ADJUSTMENTS in the basal insulin dosage (as above), supplements are temporary additional doses used when food or activity pattern is not stable or during illness or other stress.

Basic Premises:
* Only REGULAR insulin should be used for supplements.
* Supplements should be recorded separately from the basal dose to avoid misinterpretation (e.g., R 5+2, instead of R 7).
* Supplements should be only for situations which occur occasionally. If the supplement is needed frequently, it should be incorporated into the daily basal dose.

Supplements may be:
A: COMPENSATORY: Extra insulin taken when glucose is high due to a definite reason. Any illness (even minor like common cold, flu, diarrhea), infection, injury, dental work, surgery or even severe emotional stress can increase the body's need for insulin. The usual amount of insulin becomes inadequate, and ketoacidosis can result.

**How to Calculate An Extra Dose:**
A sick day supplement dose should be 10-20% of the usual insulin dose (depending on blood glucose levels and urine ketone levels).

<table>
<thead>
<tr>
<th>BG</th>
<th>Urine Ketones</th>
<th>Extra Reg. insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>250-300</td>
<td>Trace to Small (15)</td>
<td>10%</td>
</tr>
<tr>
<td>300-350</td>
<td>Moderate (40)</td>
<td>15%</td>
</tr>
<tr>
<td>&gt;350</td>
<td>Large (80-160)</td>
<td>20%</td>
</tr>
</tbody>
</table>

* No extra insulin needed if only the urine ketones are positive.
* Test again after 4-6 hours: if BG still high and ketones present, repeat this extra dose and test after 4-6 hours. If condition not improved, contact doctor. Do not try giving a third dose.

B: ANTICIPATORY: Extra insulin taken to prevent anticipated high BG, e.g., heavy meal or missing usual exercise: also should be 10-20% of the usual dose, for situations when extra food (party, marriage, festival) expected. However, if unusual activity also anticipated (dancing, long walk), supplement may not be needed. BG strips should be kept handy in case of doubt.
RESIDENTIAL CAMPS FOR CHILDREN WITH DIABETES.

Aspi Irani (from CAPENEWS issue 8, August 1999)

The responsibility for day to day management of childhood diabetes rests entirely with the patient. Patients/families have to learn how to inject insulin, check blood glucose and urine acetone, plan meals and physical activity, adjust insulin dosage to avoid hypo- or hyperglycemia, prevent and manage initially diabetes related emergencies (ketoacidosis/hypo-glycemia). However, mere learning is not enough: they must also be in the right frame of mind to implement it all. Hence the two most crucial aspects of diabetes care are intensive patient education and addressing psychosocial needs.

With this in mind, the Juvenile Diabetes Foundation (Maharashtra chapter) has been organizing annual residential camps for children with diabetes and their families since 1985. These camps are conducted at the St. Xavier's Villa at Khandala, a beautiful hill station near Mumbai. The place has comfortable accommodation for over 200 people, 2 large lecture halls with adequate audio-visual facilities, 4 seminar halls for small group discussions, a spacious kitchen and dining hall, acres of open space for children to play and also an open air stage! The four day camp is held during the Christmas vacation when the weather is pleasant, there is no water shortage, schools are closed and 2 of the days are bank holidays making it easy for busy parents (and doctors) to attend. The JDF team includes diabetologists, psychiatrists, dietitians, clinical psychologists, educators and volunteers. An essential feature is including grown up childhood diabetics who serve as role models and a source of inspiration to the young ones.

Camp activities:
1. There are demonstrations (injection technique, BG/urine testing, glucagon administration) and lectures (decision making in self care: meal planning including eating out; exercise planning; home monitoring records: interpretation and action; hypoglycemia and sick day management). Those families with limited capacity to learn are taught in smaller groups and teaching is restricted to essential basics.
2. Every child takes insulin shots and tests BG and urine acetone under supervision throughout the camp thus perfecting the techniques. Some children who are initially reluctant to take their own shots invariably relent on seeing their newly found friends self injectino without fuss.
3. Every child undergoes a fundus exam and BP check; those older than 10 years with diabetes for > 5 years also have urine Micral testing.
4. Detailed discussions are held with teenagers and the parents in small groups on social and emotional aspects: social acceptability; dangers of secrecy; revealing to peers and others; importance of proper education; future employment; marriage and child bearing.
5. Correct and factual information is provided about long term complications, stressing the role of good control and early detection.
6. Newspaper and journal reports of miraculous cures and insulin substitutes are discussed and put in the right perspective so that patients do put their lives at risk with these false hopes.
7. Most new patients get the consolation of knowing that so many others are also managing cheerfully with this illness. Enduring friendships are established which ensures continuing support and sharing even after the camp. The patients develop a special bonding with members of the medical team which is very important for successful management of this chronic disease.
8. An entertainment program every night when diabetic children put up various shows: dances, songs, plays (often with a diabetes slant) and show their parents what they are capable of!

The next camp will be held in Dec 1999. The charges for the last camp were Rs. 800/- for children and Rs. 1000/- for a parent. This included lodging and boarding for all 4 days and transport from Mumbai and back. (Camps are run on a no-profit-often-loss basis!!) Those interested in joining the next camp may write for details at: Dr. Aspi J. Irani, Juvenile Diabetes Clinic, Lotus Eye Hospital Campus, North-South Road No.13, Opp. Juhu Gymkhana, Juhu, Mumbai-400049.
BENEFITS OF CONDUCTING DIABETES PATIENT EDUCATION CAMPS.

D Maji (from CAPENEWS, Aug 2006)

Education is the most important aspect of diabetes care. According to the World Health Organization, education is the cornerstone of diabetes management. It shows people with diabetes how to take control of their condition, integrating their daily routine of self monitoring discipline into their daily life. Such education is more essential in management of Type 1 diabetes. Sometimes it becomes a tough task for the parents and doctors to motivate the child to maintain the regularity of the treatment regimen. Conducting diabetic camps, involving patients, guardians and caregivers, staying together for few days in a place, has been found to be a very effective method of patient education.

Two types of camp can be arranged:

1. Daytime awareness camp
2. Residential camp

**Daytime awareness Camps:** This type of day long camps can be easily arranged in places near the city, often with the help of voluntary organizations. Day long interactions with the patients, family members and the caregivers: group discussions, small talks, pre- and post-meal blood sugar estimations, diabetes quiz, a bit of health check-up: are quite useful. Both Type 1 and Type 2 diabetics benefit from such camps.

**Residential Camps:** This type of camp is preferred for Type 1 diabetics and their family members. The campers - patients, their family members, dietitians, physical instructors, doctors and other care givers- all stay together in a campus educational program for 3 to 7 days. During this time, all day-to-day essential activities such as insulin injection technique, glucometer use, and self monitoring of blood sugar are observed; talks by local experts are given, physical training imparted and detailed health check-up done. At the end of the day, in the evenings, the recreational programs are an added attraction for the children.

We have been conducting annual residential JD (Juvenile Diabetes) Camps for the last 10 years. The details of our camps held since 1995 are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Place</th>
<th>Distance from Kolkata (km)</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>Joyland Resort</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>Joyland Resort</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>BEd College, Belur Math</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>RKM Boarding School</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>RKM Boarding School</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>Social Dev Center, Ranchi</td>
<td>612</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>Taki Municipal Guest House</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>RKM Boarding School</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>RKM Boarding School</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>Sal Piyali Resort Jhargram</td>
<td>184</td>
<td></td>
</tr>
</tbody>
</table>

A resort, a boarding school or college hostel are preferred during their holidays when their infrastructure remains empty and can be used with little cost.

Purpose of JD Camps:

** Educational

* Diabetic education by short educational talks
* Nutrition education and practical demonstration by dietitian
* Checking insulin injection technique
* Diabetic Quiz

** To instill confidence in the patients and family members

* Group discussion, interaction with the family members
* Mixing and sharing thoughts
* Follow others who are confident

** Health check-up and monitoring
** Physical activity and training
** Recreation and relaxation

** Research

* Projects related to diabetes care can be undertaken as most patients attend.
* Every year, health data is recorded and analyzed; new therapy is planned.

Benefits to campers:
* Feeling at ease, learning to understand diabetes
* Improvement of their self management skills
* Gaining self confidence, learning to talk freely about diabetes and other issues.

Benefits to the family:
* Sharing the responsibility for day-to-day supervision of the child with trained adults and experienced young people
* Getting the latest information in diabetes care
* Feeling reassured that their child can live a long and healthy successful life, participate, perform and gain confidence.

In the last 10 years of holding regular annual JD Camps, we have observed the several improvements in the patients who attended more than one camp, which we believe will help in improving their quality of life and their diabetes care.

Benefits of 10 years of camping
<table>
<thead>
<tr>
<th>Parameters</th>
<th>1995</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean fasting BG</td>
<td>165</td>
<td>125</td>
</tr>
<tr>
<td>Mean PP BG</td>
<td>247</td>
<td>168</td>
</tr>
<tr>
<td>Home monitoring of BG</td>
<td>18</td>
<td>82</td>
</tr>
<tr>
<td>Exercise &gt; 4 days/week</td>
<td>22</td>
<td>87</td>
</tr>
<tr>
<td>Quiz (50% or more marks)</td>
<td>45%</td>
<td>85%</td>
</tr>
</tbody>
</table>

**Conclusion:** In conclusion, one can assert that regular residential JD Camps improve self care management, metabolic control, well being and quality of life, while helping in prevention of long term complications of diabetes and ultimately decreases the costs of diabetes care.

References:


CONSENSUS GUIDELINES 2000

(from CAPENEWS Vol 4, issue 3, December 2000)

(ISPAD guidelines on the management of Type 1 Diabetes in children and adolescents: SUMMARY of essential recommendations and requirements. Detailed guidelines can be obtained from ISPAD members/ Novo Nordisk subsidiaries; or viewed at www.ispad.org, or www.novo.dk)

• All health care providers at local, regional and national levels have a duty to ensure that children and adolescents receive an uninterrupted supply of
  ◊ INSULIN of reputable quality
  ◊ SYRINGES and NEEDLES which are essential for the proper administration of insulin
  ◊ BLOOD & URINE TESTING EQUIPMENT which is essential for monitoring of metabolic control

• All children, adolescents, their families and other care givers should have access to
  ◊ age appropriate support, care and education in diabetes with the aim of enhancing self management for young people
  ◊ health care professionals with experience and expertise in the management of both diabetes and child health care
  ◊ twenty-four hour advice and support for the safe and effective management of acute emergencies
  ◊ availability of written information and guidelines on the management of the different phases of diabetes in childhood and adolescence

• All health care providers at local, regional and national levels should be aware of
  ◊ the enormous personal, social and psychological burdens of childhood diabetes on the individual and families
  ◊ the potentially devastating long term consequences of poorly managed diabetes including the substantial financial costs to individuals and to health care services
  ◊ the need for adequate technical, financial and human resources to improve the total management of young people with diabetes

SPECIFIC RECOMMENDATIONS

Diagnosis and presentation
◊ There is a need for greatly increased awareness of the symptoms of diabetes both in the general public and in the health care professions
◊ Prompt diagnosis and rapid treatment are essential if the complications of diabetic ketoacidosis are to be avoided
◊ Weight loss, increased thirst or excessive urination in a child must always be investigated immediately by at least a urinary glucose test
◊ There is a need for greater awareness, accurate assessment and methods of prevention of the less common forms of diabetes particularly the increasing prevalence of obesity related type 2 diabetes in certain ethnic groups
◊ Children developing diabetes in locations remote from specialized centers require particular attention to ensure safe consistent care and continuing management

Early management
◊ Education is the keystone to successful management. It needs to be structured, patient – centered and appropriate to the level of maturity and understanding of the young person and family
◊ Educational messages require repetition and the curriculum needs regular re-evaluation
◊ Education, emotional support and teaching of practical skills is best provided by a

Multidisciplinary Children’s Diabetes Care Team (DCT), the members of which are appropriately trained in both diabetes and child/adolescent health and consist of
* Specialist/Consultant Pediatrician (or adult physician with a special interest in adolescent diabetes)
* Diabetes Specialist Nurse or Nurse Educator
* Pediatric Dietician

and there should be easy access to services for children provided by
* Social workers, counsellors / psychologists / child psychiatrists, ophthalmologists and podiatrists
  ◊ Resources should be made available for the Diabetes Care Team to be based in specialized regional or
district children’s diabetes centers
  ◊ The importance of “a good start” to the early education of the young person with diabetes cannot be
overemphasised and is more likely to be provided by teams working in centers of excellence
  ◊ Most children developing diabetes will be admitted to hospital for immediate management but if 24
hour community facilities are available domiciliary management has been shown to be successful
  ◊ Parents should be able to stay with their children in hospital at all times

Crisis and emergency management

◊ It is good clinical practice for young people and care givers to receive advice on how to adjust insulin
to maintain glycemic control especially during episodes of intercurrent illness, hyperglycemia or
hypoglycemia. It is recommended that
  * short / rapid acting insulin should always be available for crisis management
  * insulin should never be stopped except on the advice of an experienced member of a DCT
  * young people should always carry with them a supply of glucose or sucrose
  * glucagon should be immediately available to care givers
  ◊ Recognition of the earliest signs of both hypoglycemia and DKA are essential parts of the educational
curriculum. All care givers including relatives, baby sitters, teachers, sports instructors and youth
leaders should have easy access to such information particularly the management of hypoglycemia
  ◊ Centers managing young people with DKA must always have available
    * a written protocol
    * senior medical personnel experienced in the management of DKA to provide emergency advice
    * a specialized children’s inpatient facility ( with access to ITU whenever possible)
    * specialist children’s nurses trained to perform frequent, careful, clinical monitoring
    * laboratory facilities able to provide rapid, frequent, biochemical measurements

Outpatient management, monitoring and metabolic control

◊ Regular, uninterrupted, consistent follow up of young people for the optimal management of their
diabetes should be provided by the DCT
  ◊ Frequent reassessments are recommended in the first weeks and months after diagnosis to enable
optimal metabolic control to be achieved. Thereafter it is common practice to organise at least 3-4
visits per year to a children’s specialist diabetes clinic
  ◊ It is recommended that self monitoring of blood glucose is the best method of measuring short term
glycemic control and is of good educational value
  ◊ It is good clinical practice to organise an annual review with assessment of
    * growth, development, education and psychosocial changes
    * injection sites and techniques
    * glycemic control
    * puberty
    * nutritional plan and dietary management
    * associated conditions ( goitre/thyroid dysfunction, celiac disease, skin or foot problems )
    * complications screening
  ◊ Facilities for the measurement of glycated hemoglobin (preferably HbA1c) should be available to all
centers caring for young people with diabetes. There should be regular quality control comparisons
with national and DCCT standards
  ◊ It is good clinical practice to measure HbA1c at least 3-4 times each year, preferably by capillary
collection methods and available at the time of the clinic visit
  ◊ For each individual the targets of optimal metabolic control should be the lowest achievable blood or
urinary glucose profiles and HbA1c levels without the occurrence of frequent or severe hypoglycemia
  ◊ The DCT and Voluntary Organizations should be encouraged to develop out of clinic activities such
as support groups, educational events, holidays and camps

**Nutritional management**

◊ Specialist dietetic advice should be available at the time of diagnosis and regularly afterwards to provide essential dietetic advice for achieving glycemic control which is to distribute the intake of food energy and carbohydrate to balance insulin action profiles and exercise levels.

◊ Total energy intake must be sufficient for optimal growth but to avoid obesity.

◊ Total energy intake should be distributed as follows:
  
  **carbohydrate > 50%** (mainly complex unrefined higher fibre carbohydrate)
  **fat 30 – 35% (< 10% saturated fat)**
  **protein 10 – 15% (decreasing with age)**

◊ Fruit and vegetables are strongly recommended.

**Psychosocial and financial issues**

◊ It should be recognized that psychosocial influences are of paramount importance in the management of childhood diabetes.

◊ There must be no stigma/ discrimination against children and adolescents with diabetes. They should have equal opportunities and social rights in education, schools, colleges, employment and insurance schemes.

◊ Care givers should have easy access to expert advice on the financial and social support available from local services, the state and voluntary organizations.

**Adolescence**

◊ Special facilities should be developed for adolescents and young adults to help manage their own diabetes in an optimal environment and to negotiate the difficult transition between children’s and adult services.

◊ It is good clinical practice to organize joint transition clinics with the involvement of both pediatric and adult specialist teams.

◊ Specific advice should be made available to adolescents on the influence of diabetes on puberty, growth, vascular complications, metabolic control, exercise and information made available on pregnancy, contraception, smoking, alcohol, recreational drugs, driving and employment.

**Vascular complications**

◊ Awareness of potential long term microvascular complications is a fundamental part of diabetes education: it should be provided at a rate appropriate to the young person’s understanding and maturity.

◊ Positive encouragement should be provided to emphasise that improvements in metabolic control reduce the risks of complications.

◊ Screening recommendations

**Retinopathy and Nephropathy**

** Prepubertal onset of diabetes: 5 years after onset or aged 11 years or at puberty (whichever is earlier)

** Pubertal onset of diabetes: 2 years after onset

**Thereafter annually**

**Assessments should include at a minimum**

+ Eye examinations (preferably dilated pupils and retinal photography)
+ Albumin excretion (preferably microalbuminuria)
+ BP measurement
+ Clinical review of possible neurological dysfunction

**Associated conditions**

◊ Height and weight monitoring is an essential part of diabetes care.
◊ Assessment of associated autoimmune and other conditions should be performed at annual clinic review (see above)

**Surgery**

◊ A written protocol should be available in all centers caring for young people with diabetes to ensure the safe management of children/adolescents under-going surgical procedures. The protocol should be agreed between anesthetic, surgical and pediatric colleagues

**Audit, training and research**

◊ Health care providers and DCTs should ensure that there is comprehensive population based diabetes register (either manual or computerized) which includes the names of all young people within a particular area or region. Regular register reviews and audits will assist in the evaluation of standards, assessment of outcome and to identify young people who default and thus help to ensure their consistent support and surveillance

◊ Improvements in the training of Specialists providing care for children and adolescents is essential. The training should include not only diabetes care but education theory, psychology, counselling and the mechanisms of behaviour change

Research initiatives which help to investigate not only the etiology, development and prevention of diabetes and it’s complications but also optimal methods of care and management should be encouraged at local, national and international levels. Training in research methods and specific training fellowships in pediatric diabetes will help in promoting such research.
INSULIN PUMP THERAPY: INITIAL INDIAN EXPERIENCE AND THE PATH AHEAD

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Summary
Continuous subcutaneous insulin infusion (CSII), or insulin pump therapy, has been used to treat diabetes since the late 1970s. CSII can provide better care and improve quality of life for some children and adults with diabetes. Successful implementation of pump therapy requires a patient (adolescent/adult) or a parent (in case of young children), who is motivated, educated, and available/involved at all times to manage the pump and the background total diabetes care. In children, this therapy poses unique problems not faced in adult diabetes management. Samatvam Endocrinology Diabetes Center, Bangalore, has been using insulin pumps in children, adolescents and young adults since 2003. The primary factor for the success of the “Karnataka” insulin pump program has been the involvement of a very dedicated, technologically savvy (“gizmo friendly” - professionally a computer hardware specialist), creative and compassionate Certified Pump Trainer, who also happens to be a Type1 diabetic insulin pump user.

Background
The theoretical advantage of the insulin pump is its ability to meet physiological insulin needs by mimicking physiological insulin release in people with insulin deficiency. The basal and bolus functions of the pump allow separate determination and adjustment of both these insulin requirements and also allow flexibility in timing and amounts of nutritional intake and physical activity, allowing for wide variations in lifestyle. In addition, use of short-acting insulin makes coverage of the early morning glucose rise (“dawn phenomenon”) possible, eases sick-day management, and matches nutrient absorption more physiologically, thereby reducing the risk of hypoglycemia.

In several studies, pump users show a high degree of satisfaction, and most had fewer episodes of severe hypoglycemia. However, studies regarding safety and efficacy are mixed. Some show a decrease in HbA1c, whereas others show no durable improvement. Some report that HbA1c improved in the first few months but returned to pre-pump status after 1 year. Some show an increased risk of diabetic ketoacidosis (DKA) and body mass index. Recent comprehensive reviews of insulin pump therapy, in both pediatric and adult populations, show that blood glucose (BG) and HbA1c levels are similar or slightly improved when pump therapy is compared with multiple injection regimens. Rates of DKA are similar; hypoglycemia is less frequent with pumps. A few easily manageable site infections occur, none of which require surgical intervention. Monitoring >4 times/day and greater parental involvement (in children) are associated with lower HbA1c levels. Thus, personal behaviors, not just the mode of insulin delivery, are important and must be considered when addressing management issues with families. Larger clinical trials in children, adolescents and adults will help to clearly define the impact on metabolic control, morbidity, and mortality. Though extensive experience has been gained worldwide with insulin pumps in adults and older adolescents, its application in younger children needs several special considerations. One of the cardinal rules for successful pump use is that individuals using it need to be committed to the therapy and participate actively in their diabetes management.

Preschool children cannot be active participants in their therapy and usually will have very little say in whether their diabetes is managed with a pump. School going children can generally participate in the decision to use/ not use pump therapy and may even be able to learn to manipulate pump functions, but cannot troubleshoot pump functions when diabetes control is poor, or be relied on to appropriately calculate and administer bolus doses independently. This means that the parent or caregiver is actually the insulin pump "user" in the case of preschool and even elementary school children. Thus, pump initiation in young children involves several additional steps not required for adult pump users. In addition to the medical management issues, there are a number of practical considerations in very young children. Their small body size provides relatively few areas for infusion sites, frequently leading to lipohypertrophy and occasionally severe lipoatrophy. In addition, as preschoolers lose their "baby fat," the decrease in subcutaneous adipose
tissue requires more frequent set changes, so that preschool/elementary school children often need to anticipate set changes every 48 h. This is especially true for active children.

The psychosocial impact of insulin pump therapy is another area where critical evaluation is needed. In the absence of an ongoing partnership between the child and parent, no diabetes management strategy will be successful, including insulin pump therapy. At best, a pump may be able to avoid some of the extreme high and low BG values found in active preschoolers using split-mix insulin regimens, but it will certainly not provide the smooth BG values seen in adults with more stable eating and behavior patterns. Parents/medical providers expecting consistent BG results will be frustrated and disappointed with CSII therapy. Members of the diabetes care team must be alert to parents’ and children’s anxieties and help each family identify the care solution most useful to them.

Indian experience

Between 2003 and March 2005, 12 children and youth with diabetes associated with our health care team, have chosen to utilize insulin pump therapy to improve their glycemic control and lifestyle (11 with type I diabetes, one with diabetes secondary to non-alcoholic pancreatitis). At start of pump therapy, their ages ranged from 7 to 35 y, and duration of diabetes from 3 months to 19 years. Baseline frequency of BG monitoring was none to 4 times per day.

Patients and families chose insulin pump therapy for several reasons, including better control, less BG variability, fewer injections, and improvement in lifestyle flexibility. Examples included a 30 y old sales and service professional with extensive daily car driving, inability to control meal timings during a business day, and a morbid fear of dying from hypoglycemia (the pump apparently removed the life-disrupting “fear” factor); a 17 y old lean college student fed up of the numerous restrictions imposed by the multiple injections and the inability to eat what and when he wanted; a 7 y old school girl with wide fluctuations of BG (17 to > 500 mg/dl) and a pronounced dawn phenomenon >300 mg/dl; a 25 y old school teacher with severe dawn phenomenon and early morning ketosis; who was planning a pregnancy, and a 27 y software engineer wanting the best after 19 years of diabetes.

Before insulin pump therapy is started, all patients and families need to demonstrate a desire and ability for intensive management with multiple daily injections, frequent BG monitoring, satisfactory record-keeping details, ability to make appropriate insulin dose adjustments, and accurate carbohydrate counting. Before initiation, all patients and families were instructed in carbohydrate counting, and also the mechanics of pump use. MiniMed 503 (Northridge, CA) insulin pumps were used. At the time of pump placement, no patient was admitted to the hospital: all counseling and demonstrations were done in the Diabetes Center and their homes. During the first month, frequent BG monitoring was advised: usually 7 point profiles, including pre-prandial, post-prandial, and overnight levels. Insulin doses were determined for basal rates, insulin-to-carbohydrate ratios at each meal, and correction boluses; these doses were adjusted and refined based on BG responses. Nutrition evaluation and assessment were also done. Patients recorded all BG levels, basal and bolus doses, and carbohydrate grams on pump recording sheets. All patients used lispro insulin.

Risks of pump use and risk prevention were discussed in detail with all patients. This included site infections and the potentially increased risk of hyperglycemia, ketosis, and DKA. Hypoglycemia awareness, prevention, and treatment were also reviewed. Problem-solving strategies for potential mechanical problems that could cause lack of expected insulin delivery (e.g. air bubbles, kinked infusion sets, or dislodged tubing) were discussed. After the pump start, all patients had daily phone contact with the Certified Pump Trainers (particularly the one who himself is an insulin pump user—“their greatest friend and big brother”, who provided 24 hour access, and unlimited house visits as purely non-commercial social work!), and periodic review by the diabetologist and other team members. Many new pump users felt they received most useful practical tips through interactions with older/senior pumpers (“club effect”, with occasional social get-togethers). After the first follow-up clinic appointment, visits took place at the usual clinic schedule every 1–4 months. These visits included medical, nurse educator, and nutrition evaluation and assessment. Glycemic goals were discussed at each clinic visit, and if not met, more intensive “reeducation and continued education” and corrective actions were recommended. On the whole our experience has been rewarding.
In summary, pumps are a useful addition to the armamentarium of the pediatric diabetologist, but must be used appropriately, with due care.

References

The costs of using Medtronic pumps are (exclusive of local taxes):
a) Paradigm 712 with 4 yr warranty costs Rs 1.5 lakh,
b) Model 508R with 2 yr warranty costs Rs 85,000,
c) Monthly kit with disposables cost Rs 4,300.

In all pricing, the training on the pump and the support is free of cost. The pumps are sold by trained local distributors. For patients who are not sure about the therapy, trials are an option and can be offered to genuine patients.
Diabetic pregnancy managed by insulin pump therapy (Aug 2004)

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Continuous subcutaneous insulin infusion (CSII) is thus far the most effective way to maintain euglycemia in type 1 diabetes mellitus (DM1). Even though it has been used extensively in the west, its use in India is still very limited. Our case demonstrates the use of insulin pump in a pregnant DM1 patient for the first time in India. She was a 34-year-old lady married for the past 2 years and with one miscarriage. When first seen in our institute, she was on twice-daily premixed insulin, with an HbA1c of 9.9%, frequent nocturnal hypoglycemia, and hypoglycemia unawareness.

Figure: Shows the serial HbA1c levels in our subject. Note that she conceived once HbA1c levels reached 7.7%. However, once CSII was started, the HbA1c showed further reduction, and eventually reached to almost non-diabetic levels.

Continuous glucose monitoring was performed to assess her glucose profile. Based on the results, the insulin dosage was adjusted. She was placed on 3 doses of short acting insulin before each meal with NPH insulin at bedtime. With this regimen, her HbA1C fell to 7.7% and she conceived. Early pregnancy was complicated by wide and unpredictable fluctuations in blood glucose and nocturnal hypoglycemia. In view of this she was placed on insulin pump (CSII) therapy. With CSII it was possible to maintain her HbA1c below 7% throughout pregnancy and avoid nocturnal hypoglycemia. No maternal complications were noted throughout pregnancy. She had, at full term, a normal vaginal delivery of a 2.9 kg baby with no congenital anomalies. Currently both mother and baby are healthy. The mother opted to continue CSII: her glucose levels remain well controlled on pump therapy.

Erratic blood glucose control, hypoglycemia unawareness and optimization of glycemic control during pregnancy are widely recognized indications for commencing patients on continuous subcutaneous insulin infusion (CSII) using an insulin pump. The beneficial effects of glucose control therapy on maternal and fetal outcomes in pregnancy are well known. As far as pregnancy is concerned, CSII is a reasonable choice in subjects remaining uncontrolled on multiple daily insulin injections. CSII offers better glycemic control and greater lifestyle flexibility, so it is a good option in difficult cases. The efficacy of CSII in pregnancy has already been well established, and CSII had been used extensively during pregnancy in subjects who had enrolled in the landmark Diabetes Control and Complications Trial. To our knowledge, this is the first reported case of a diabetic pregnancy treated with CSII in India. With the increasing availability of pump therapy in India, it is hoped that the experience with CSII in Indian patients is broadened further.
Brief abstracts of some APPES 2006 presentations (Thailand): Plantar Fascia thickness- a novel measure of tissue glycation. (Maria E Craig et al, Children’s Hospital at Westmead, Sydney, Australia)

Skin collagen glycation may be an early marker for development of microvascular complications in patients with type 1 diabetes. This study investigated the relationship between plantar fascia thickness (assessed by ultrasound), glycemic control (HbA1c) and subsequent development of micro-vascular complications (retinopathy assessed by using seven field fundal photography and albumin excretion rate (AER) from 3 consecutive timed over-night urine specimens).

Median age was 13.3 yr (12.7-14.4), DM duration 5.5 yr (3.9-8.3) and time between first and last assessment was 2.8 yr (2-3.8). Using multiple regression analysis, plantar fascia thickness was a significant predictor of subsequent development of retinopathy: OR 3.8 (95% CI 1.5-9.7), along with HbA1c: OR 1.2 (1.1-1.4). Plantar fascia thickness was a significant predictor of early elevation of AER (>7.5ugm/min): OR 4.55 (1.52-13.67), but HbA1c was not significant in this model.

**Conclusion**: This is the first study to demonstrate that increased tissue glycation, as measured by plantar fascia thickness, is a significant risk factor for subsequent development of micro-vascular complications in adolescents with type 1 DM, independent of glycemic control.
Hyperinsulinemic hypoglycemia:
Congenital hyperinsulinism is a heterogeneous disorder. 18Fluro-L-Dopa PET scanning is highly sensitive for differentiating focal from diffuse disease as well as accurately locating the focal lesion. This is crucial, as removal of the focal lesion will result in “cure”, while most infants with diffuse disease would require near total pancreatectomy. (K Hussain)

Neonatal DM:
Some of the persistent and the transient forms are due to activating mutations in the genes (ABCC8 and KCNJ11) encoding the SUR1 and KIR6.2 proteins of the pancreatic beta cell KATP channel respectively. These patients respond to oral hypoglycemics (sulphonylureas) and their insulin therapy can be discontinued. A subgroup of these patients has developmental delay and epilepsy which also improves with oral sulphonylureas. Hence, all patients with DM diagnosed before six months of age should have mutational analysis for the ABCC8 and KCNJ11 genes. (K Hussain)
Elevated BP at night is the first sign of hypertension in children with DM. Angiotensin receptor II blockers are better used for treatment in hypertension. (F Chiarelli)

Infants of diabetic mothers:
Correlation was found between infant macrosomia and maternal fatness, serum IGF-I and IGF-2, but not with maternal HbA1c. (W Cutfield) Symptomatic hypoglycemia is more commonly seen in offspring of T1DM mothers than those with T2DM. (W Cutfield)

Infantile onset DM:
11 cases analyzed; mean age of presentation was 3 months. 6/11 cases had syndromic association (Wollcot Rallison syndrome). It was emphasized (as would have been the practical experience of many of us) that maintaining good glycemic control was difficult as the babies require small doses and there is difficulty in availability and administration of such small doses. Hence there is a need for newer insulin delivery systems for better titration and thereby preventing complications. (R Ganesh, T Vasanthi)

Behavioural and marriage problems in people with T1DM:
A survey of over 100 T1DM patients reveals that most of them are not comfortable in social gatherings, and it is relatives who hurt them the most. A significant number felt that they should not make their disease public. Marriage problems were more for the women, and a significant proportion felt they should not get married, which was not the case with the men. Spreading awareness about T1DM and insulin therapy is the need of the hour. (R Shukla, D Yagnik)