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SURGERIES AND CARDIOVASCULAR SYSTEM



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Evolution of Renal Transplantation - 30-Year Experience from a Single Center

By Viktor Denisov, Vadym Zakharov, Eleonora Komissarenko, Eugene Onischenko, Tatyana Golubova, Sergey Kichatyi & Olga Zakharova

Abstract- Aim: To summarize our single – center experience in renal transplantation (RT), analyze the trends and review the influence of these trends on outcomes of RTx for further evaluation of its therapeutic potential and better understanding the tasks for professionals.

Methods: Our Center performed 705 kidney transplants (RTx) between April 1986 and October 2016. The median recipient age was 42.6 years with M:F ratio of 1.6:1. Most of them were on hemodialysis (96%), 28 patients received pre-emptive transplant, 517 (73.3%) transplants were from deceased donors, 184 (26.7%) were from living donors.

Results: Patients in the start and more late stage of transplant program had the following significant differences: the range of their age has been changed from 14-62 to 6-71 years. Transplantations from deceased donors decreased from 98.7% to 40.3% of cases.

Keywords: renal failure, organ donation, transplantation, immunosuppression, allograft dysfunction.

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Evolution of Renal Transplantation – 30-Year Experience from a Single Center

Viktor Denisov ^α, Vadym Zakharov ^σ, Eleonora Komissarenko ^ρ, Eugene Onischenko ^ω, Tatyana Golubova ^ξ, Sergey Kichaty [§] & Olga Zakharova ^x

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Results: Patients in the start and more late stage of transplant program had the following significant differences: the range of their age has been changed from 14-62 to 6-71 years. Transplantations from deceased donors decreased from 98.7% to 40.3% of cases. Last decades, more and more patients who were not considered as transplant candidates earlier have been referred to kidney transplantation. Amount of high risk factors such as diabetes, systemic lupus erythematosus, amyloidosis and other increased dramatically. Miniinvasive and other modern surgery technology were introduced.

Immunosuppression at the beginning consisted of cyclosporine, azathioprine and steroids. Later in all cases of induction anti-CD-25 monoclonal or other depleting antibodies were used. Immunosuppression maintenance spectrum was added by tacrolimus, prolonged-release tacrolimus, mycophenolate mofetil, mycophenolate sodium or everolimus. Over the last decade steroid-free protocols were used in about 30% of all primary RTx to avoid the long-term side effects of steroid use. Immunosuppression-free protocol in one recipient with normal graft function is using last 3 years.

Our data showed that in spite of extension of indications, the number of primary functioning kidney transplant increased from 71.2 % to 78.3 %. It makes the best start for long-term rehabilitation of recipients. One-year survival of high risk recipients was 95.7 % with a good quality of life. One-year graft and patient survival in standard conditions reaches 100%. The maximum term of satisfactory function of the kidney transplanted at our Center to 44-year-old patient with chronic glomerulonephritis, is more than 26 years. Monitoring continues. Long-term follow-up revealed a large and sometimes dominant influence of the social aspects on graft and patient's survival, as well as their quality of life.

Conclusions: The results of renal transplantation indicate the possibility of prolonged rehabilitation including high risk patients. The later improvement is related to expanding of

transplant activities through education and multidisciplinary strategies.

Keywords: renal failure, organ donation, transplantation, immunosuppression, allograft dysfunction.

Core tip: In this study we analyzed our single-center data of renal transplantation between 1986 and 2016 years. Last decades, more and more patients who were not considered as transplant candidates earlier have been referred to kidney transplantation. The results of renal transplantation indicate the possibility of prolonged rehabilitation including high risk patients. The later improvement is related to expanding of transplant activities through education and multidisciplinary strategies.

I. INTRODUCTION

Donetsk Transplant Center performed 705 operations since the first renal transplantation on 17 April 1986 till October 2016. The study summarizes the experience of organizational, clinical, scientific and educational work of the Centre in order to identify further priorities for professionals.

II. MATERIALS AND METHODS

Figure 1 provides the information of the annual number of kidney transplants at the Center. The data collected retrospectively. Renal failure was a consequence of chronic glomerulonephritis, pyelonephritis, hypertension, polycystic, hypoplasia and other abnormalities, kidney stones, diabetes, scleroderma, systemic lupus erythematosus, systemic vasculitis, renal cell cancer, amyloidosis, Gudpaschura syndrome, multiple myeloma diseases. The main disease was mostly glomerulonephritis - 78.2%. Polycystic disease, diabetes or other causes were more seldom (Figure 2). The median recipient age was 42.6 years with M:F ratio of 1.6:1. Most of them were on hemodialysis (96%), 28 patients received pre-emptive transplant, 517 (73.3%) transplants were from deceased donors, 184 (26.7%) were from living donors.

Maximal duration of dialysis treatment with anuria before surgery was 13 years. Recipients in early (until 2000) and later stages (since 2000) of our work had the age differences from 14-62 years to 6-71 years.

The rate of renal cadaveric donations during decades decreased from 99.7% to 41.6% cases. In the

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last decade more and more patients who weren't previously considered as a candidate for transplantation were included in the waiting list. Miniinvasive and other modern surgery technology were introduced. The 'Custodiol HTK Solution' was used for cold storage of kidney transplants. The cold ischemia time was usually no more than 24 hours. The maximum duration of cold ischemia time with primary graft function and successful outcome of renal transplantation was 47 hours.

List of used immunosuppressants include nearly all modern drugs. The maximum term of satisfactory function of the kidney transplanted at our Center to 44-year-old patient with chronic glomerulonephritis, is more than 26 years. Monitoring continues. In the article were analyzed different aspects of renal transplantation. To assess the obtained data we used methods of parametric statistics including definition of their accuracy according to Student's criterion.

III. RESULTS

The structure of the Transplant Center: The search for the optimal structure of the Center cannot be considered as finished. Initially was created the department of chronic hemodialysis and kidney transplantation.

The type of organization in which "all doing everything," let to start the kidney transplant, but eventually exhausted itself. In 1998, this department was reorganized in the transplant Center. The Center include the transplantation department with the intensive care unit for 6 beds, organ recovery team, immunological and biochemical laboratories, dialysis department for 16 dialysis places and the consultative polyclinic reception.

The main tasks of the Center are a kidney transplantation from deceased or living related donors for adults and children's, and also preparing the conditions for a liver and pancreas transplantations. The Centre has modern equipment to do this. Organization which based on the multidisciplinary approach has established itself in the world as the most effective. Currently it's necessary the further improvement of the structure of transplant center as a base for the medical, scientific and educational work.

Selection and preparation of candidates for renal transplantation: Selection of candidates for kidney transplantation depends on the development of a network of dialysis units and transplant Center interaction with related specialists: nephrologists, internists, family physicians, pediatricians, endocrinologists. In our opinion, dialysis should be performed only under the absolute contraindications or the patient's informed refusal of kidney transplantation after consultation in the transplant Center. Kidney transplantation as the least expensive method must be

performed on the basis of the budget and have priority in relation to the funding of dialysis.

All candidates for transplantation pass the standard examination in order to exclude the absolute and relative contraindications for the surgery. We prepare the candidates with the bicarbonate hemodialysis on the modern equipment. In the treatment are used erythropoietin, calcitriol, antihypertensives and other drugs which are situationally appropriate.

Organ donation: The technical aspects of kidney donation generally resolved, although it continues to improve. We transplant the kidneys with multiple renal arteries, veins, doubled ureters and other expanded criteria. However, the shortage of organ is the main problem which affects transplant activity.

Picture 3 provides the information about types of donors for renal transplantation in the different years.

The trend of the recent years is increase the proportion of the living related donation, which is not able to solve the organ shortage problem. After introduction of legislation in 1999, "the presumption of informed consent" for the organ donation after death, renal transplantations from deceased donors decreased from 98.7% to 40.3% of cases. During the last decade the decision about donor supply begin by the examination the possibility of related donation. In the absence of conditions for its implementation the patient is included in the waiting list for cadaveric donation.

The current deficit is determined obsolete form of organization of organ donation which does not provide responsibility of staff in intensive care units for non-participation in the donor process. A retrospective analysis of mortality showed that up to 40% loss of donors account is the problem of identifying a potential donor. The reasons are in the insufficient training of the medical staff of intensive care units, lack of motivation, absents of equipment for the diagnosis of brain death and the fear that the activities associated with the donor process, will cause negative reaction of relatives, administration, law enforcement agencies, as well as complicate the implementation of normal usual work. The participation of staff of intensive care units in the implementation of the organ donation requires high skills and considerable additional efforts, a complex organizational and psychological challenge. It is necessary to strengthen the material-technical base of the intensive care units, to introduce the brain death diagnostic in the algorithms of management of patients with severe dominant brain damage. The intensification of work related to the donor procurement process must be payed adequately and this question should be decided by the state.

Important element of the work can be organization within the regional Center of emergency

medical mobile team of specialists for the diagnosis of brain death with the necessary equipment.

Renal transplantation: Operative technique of renal transplantation continues to improve, due to the expansion of indications and the desire to raise the profile of its safeness. Although kidney transplants still carried out in the iliac region as the world's first successful transplant in 1954 the number of technical complications and reoperation is significantly decreased, and changed their character. This is due to the appearance of selective immunosuppressants, improvement the quality of sutures, coagulation, surgical instruments, stents, lighting, the use of lenses. The possibility of organ recovery in heart-beating deceased donors or planned nephrectomy in living-related donors with modern storage solutions, anesthesia, respiratory devices and monitor observations excluded the development of complications associated with delayed graft function in renal. In our Center renal transplantation with simultaneous ipsilateral nephrectomy is an acceptable solution, when it is necessary to remove the patient's own kidneys or impossible to form uretero-vesical anastomosis. The possibility of early accurate identification and treatment of viral, fungal and bacterial infections is improved also.

All this has allowed us to increase the survival rate of transplant recipients. In the last years we have performed most RTx for the high risk candidates: children's (43), diabetics (27), patients with systemic diseases (11), third or fourth transplantation – (9), arenal conditions (7) and other risk factors (8). Despite the expansion of indications, the number of primary-functioning kidney transplant has increased from 71.2% to 78.3%. We agree with literature data that this provided a better starting point for long-term rehabilitation of the recipients [1-7]. The comparison of the significance of graft ischemia, rejection, thrombosis, infectious and drug-induced complications allows to consider ischemia the main reason of renal graft dysfunction. If anuria continued more than one month, than graft recovery usually was not observed. Only in one case patient diuresis was renewal and patient rehabilitated with creatinine level normalization on 45th day of anuria after renal transplantation. The largest volume of urine output immediately after renal transplantation to patient with lupus nephritis reached 51,3 liters per day. Ultrasound examination of the graft showed no pathology. The patients underwent an infusion of physiological polyionic solution in the "milliliter for milliliter" mode. On the 15th day after surgery, the patient was discharged from the department in good condition with normal graft function. One-year survival of patients in high-risk surgical group was 95.7% with a good quality of life, which corresponds to the modern level [8-10]. The one-year survival rate of transplant and patients in the standard conditions reached 100%. Figure 4 provide the

information about maximum graft survival in high risk RTx recipients.

Immunosuppression: Immunosuppression at the beginning consisted of cyclosporine, azathioprine and steroids. Later in all cases of induction anti-CD-25 monoclonal or other depleting antibodies were used. Immunosuppression maintenance spectrum was added by tacrolimus, prolonged-release tacrolimus, mycophenolate mofetil, mycophenolate sodium or everolimus. Over the last decade steroid-free protocols were used in about 30% of all primary RTx to avoid the long-term side effects of steroid use (Table 1). Immunosuppression-free protocol in one recipient with normal graft function is using last 3 years.

Despite the low transplant activity, we register gradual increase of the number of observed recipients. During 2015 year we provide immunosuppressive monitoring for 139 recipients who lived in our region. Now immunosuppression after organ transplantation requires optimizing through regulation related to its organization, as well as training related professionals.

We have found that in the late postoperative period quality of life of recipients is largely determined by the presence or absence of anemia, hypertension, proteinuria, infection, renal transplant dysfunction. They demanded correction, effectiveness of which determinate the outcome of transplantation. It's consistent with the literature data [12-27].

A significant influence on the outcome of transplantation, especially in the long term period, provide non-compliance which is the basis on the loss of 25% of transplants.

In the context of immunosuppression after kidney transplantation late infections are developed more often than in the general population. They can be atypical, difficult and to be decisive in an unfavorable outcome.

Analysis of the structure of this infections showed that 70% were of viral origin, in 25.7% - bacterial, 4.3% - occurred tuberculosis. Symptomatic fungal infections in the late postoperative period were not observed.

The most difficult infections pass in the lungs and liver. In view of the data, to reduce the frequency and severity of late infection after kidney transplantation is necessary: vaccination against virus hepatitis B, the use of valganciclovir for prophylaxis and treatment of herpes viruses infections, prevention of communal infections among transplant recipients. The optimum is to provide the recipient a minimum but adequate immunosuppression within individual protocols on the basis of a wide range of modern selective immunosuppressants.

In general, the quality of life of patients with a satisfactory function of the renal transplant which is evaluated by using a questionnaire SF-36 (Short-Form

Health Survey), show that quality of life after RTx significantly higher than in dialysis patients, and approaches to the quality of healthy people life in all parameters (Table 2).

Progression of chronic renal allograft dysfunction is accompanied by the simultaneous loss of the benefits of a successful transplantation and the growth of problems due to immunosuppression. Based on a retrospective analysis of results of treatment of kidney transplant of the recipients with blood creatinine higher than 0.3 mmol/l, we adhere to the following principles in the correction of immunosuppression which allow to decrease the risk of complications in case of loss of its function.

1. Do not prescribe high doses of steroids and do not have the steroid pulse therapy.
2. Do not increase the dose of received cyclosporine or tacrolimus and stop medication if there is an increase of nephropathy.
3. To continue immunosuppression with mycophenolic acid which are not nephrotoxic.
4. To enhance monitoring of immunosuppression and prevention of infectious complications.
5. To cancel immunosuppression at returning to hemodialysis treatment. Cancellation of steroids should be done gradually - sometimes for several months. When the discomfort is associated with transplant (temperature, pain in the projection of the transplanted kidney, hematuria) short courses of low doses of steroids administered orally or intravenously can be effective.

Educational, scientific, organizational and methodical work: Today there is no doubt that the transplantology as a medical discipline should be including to the educational program for students and physicians of any profile. With our participation established programs, training manual, guidelines, tests, has accumulated a lot of information, including unique. As a result, the Centre introduced the teaching of transplantation for interns all medical specialties for 1 day and for interns' surgeons - 5 days. Allocated time does not permit to organize a full-fledged training.

This leads to late referral of the patients to the Center. It is difficult to help them because errors of the related professionals, the lack of an effective deceased donation, incorrect administrative decisions. Therefore, the work aimed at providing objective information to the public about organ transplantation is carried out by us on a permanent basis by all available means. However, to increase the effectiveness of this work is possible only with targeted state support.

Despite the fact that in the Center defended 2 doctoral and 12 candidate theses, the lack of clinical status reduces the attitude of medical personnel to transplantology as career discipline, reduces the

motivation for the research work, increases staff turnover.

IV. DISCUSSION

Almost everywhere in the world a significant intensification of transplant activity in a short time was provided at the governmental level in the framework of the standard and totally available technologies: adaptation of experts and the public opinion to perceive the concept of brain death as the criterion of human death, organization of transplant coordination, increase motivation in the implementation of the donor process [28]. Now, even in spite of the difficult conditions of wartime in Donbass past last years (since 2014), staff and material-technical base of Donetsk Transplant Center preserved and allow perform renal replacement therapy, including renal transplantation, to the way it was before the military conflict. In many ways, this contributed to a large unmet demand for this type of treatment and its good results, which is consonant with the positive international experience even in disaster medicine during renal replacement therapy [29].

Transplant surgery is based not only on technology but also on human solidarity and in fact reflects degree of maturity of a society. In the future, increasing the level of education and economic independence would create more trust and solidarity of social relations.

Transplantologists need to continue their work within the law, to promote the improvement of the regulatory framework and to get from the state correct perception of the problem of transplantology. The refusal to solve this problem creates social tension and poses a threat for the national security. Therefore, any measures aimed at improving transplant care are priority for the modern health care.

V. CONCLUSIONS

Our experience of renal transplantation confirms the principle possibility to achieve a guaranteed high level of patient's rehabilitation. The quality of medical and social rehabilitation after kidney transplantation is comparable with healthy individuals, and is much better than the patients being treated with hemodialysis.

It is necessary to increase the transplant activity. Important prerequisites to solve this problem fast enough are the global world progress and our own experience, if targeted state support will provide. State regulation in the field of kidney transplantation should be concentrated on the following priorities:

1. The decision of the legal and financial issues of strengthening the transplant center as a base for the development of clinical transplantation and optimal organizational form for the medical, scientific, educational and information work.

2. Optimization of the selection of candidates for a kidney transplant is providing mandatory centralized administrative check-up of all patients with renal insufficiency in renal transplant and total state budget funding of transplantation.
3. The introduction of diagnosis of death based on brain death in standards of intensive care units, an increase on the national level of motivation and commitment of staff of intensive care units participating in the donor process.
4. Ensuring public order to conduct information campaigns on organ transplants and the teaching of transplantation in the amount corresponding to the teaching of other clinical specialties, in order to create a positive public opinion about transplantation and increasing the professional level of specialists involved in the various stages of the transplantation.

Supportive foundations: We have analyzed only our own clinical experience outside of any special research projects. This manuscript was created on the author's initiative.

Conflict-of-interest statement: There is no conflict of interest to report.

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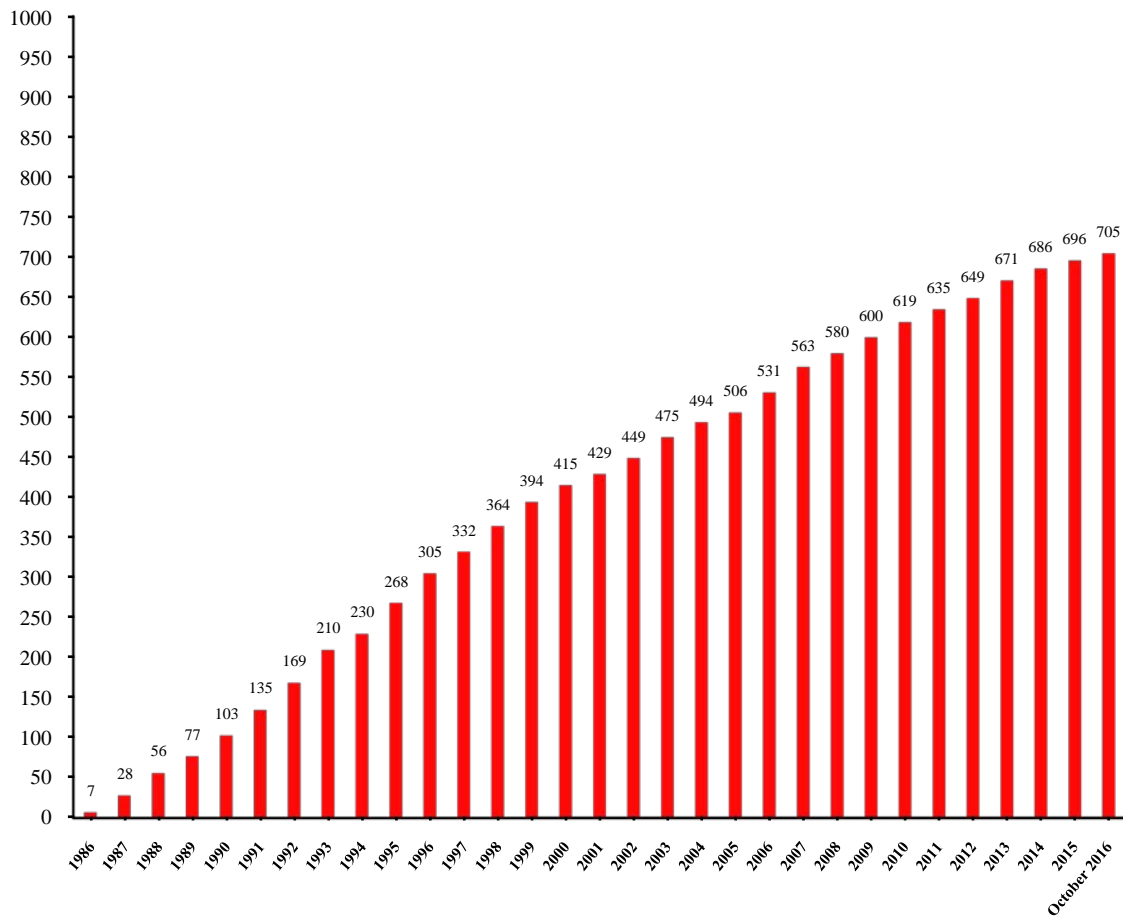


Figure 1: The cumulative number of renal transplants in Donetsk transplant center

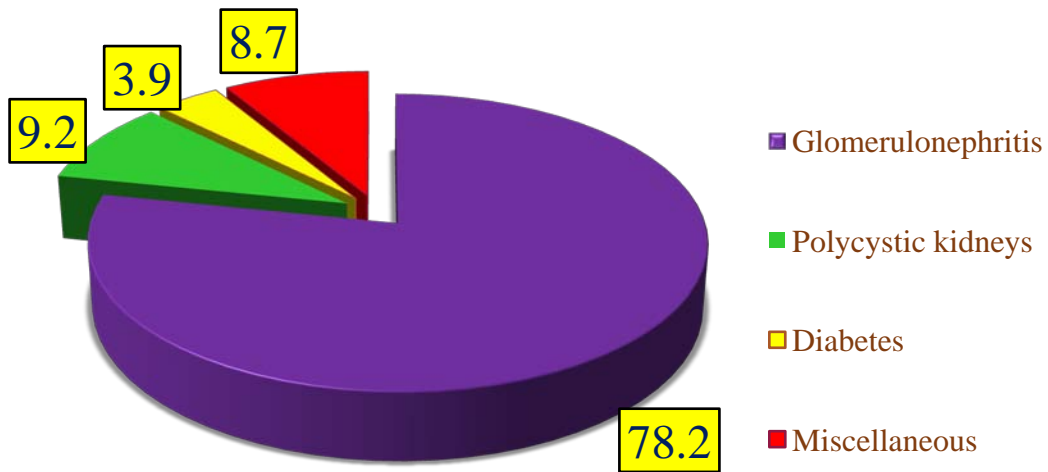


Figure 2: Etiology of end stage renal disease (%) in RTx recipients

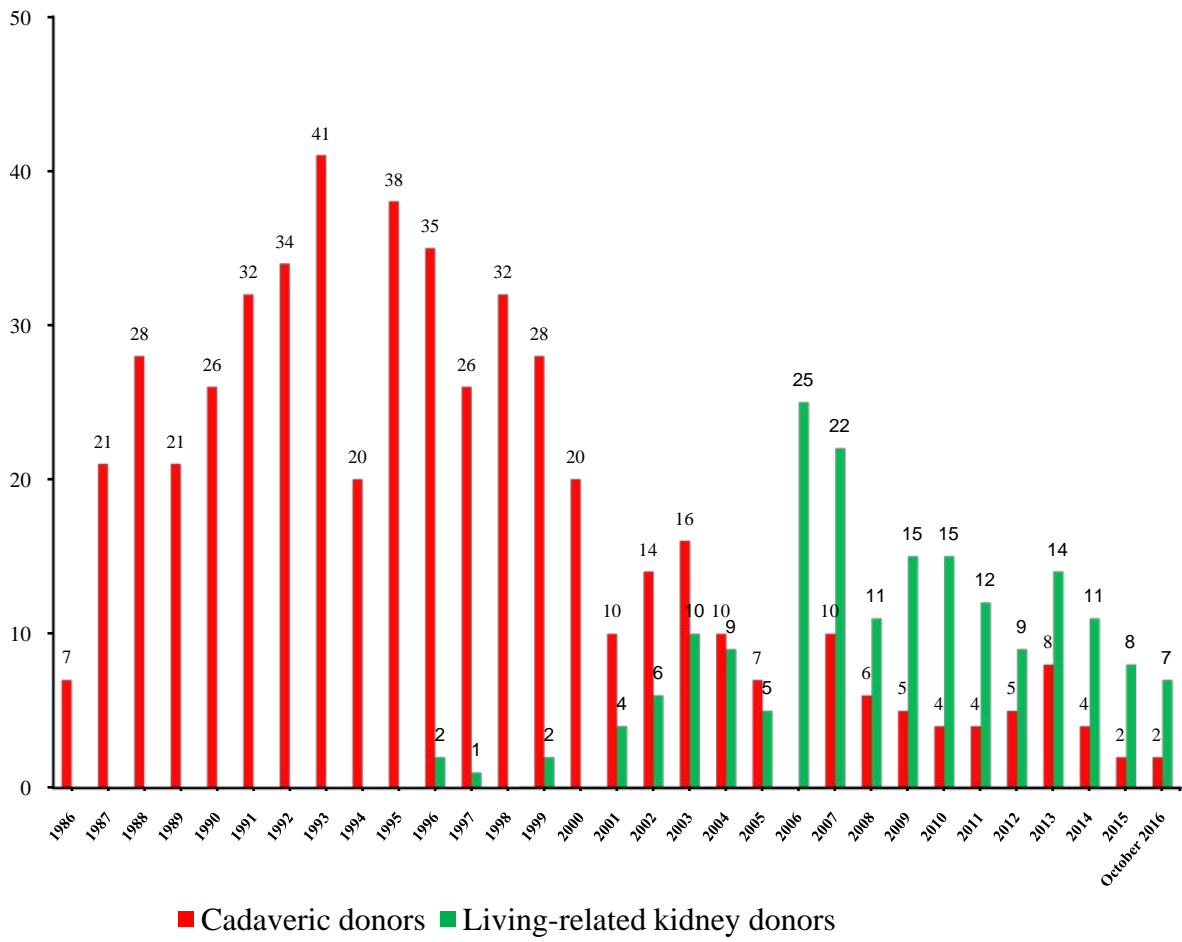


Figure 3: Types of donors for renal transplantation in the different years

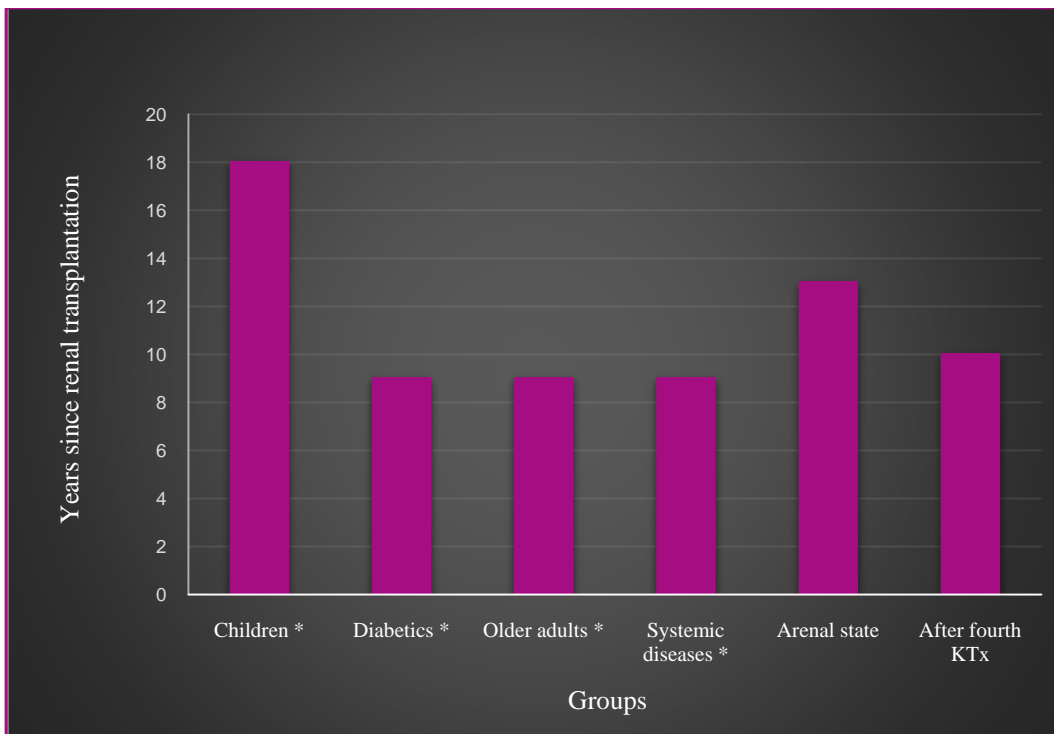


Figure 4: Maximum graft survival in high risk RTx recipients (*monitoring continues)

Table 1: Current immunosuppression after renal transplantation in Donetsk transplant Center

Current immunosuppression	
Anti-CD-25 monoclonal or other depleting antibodies	– 100% (induction)
Cyclosporine	– 75% (induction and maintenance)
Prolonged-release tacrolimus	– 20% (induction and maintenance)
Tacrolimus	– 3% (induction and maintenance)
Mycophenolate sodium	– 63% (induction and maintenance)
Mycophenolate mofetil	– 12% (induction and maintenance)
Azathioprine	– 14% (maintenance)
Steroids	– 100% (induction). Steroids – 70% (maintenance)
Everolimus	– 5% (maintenance)

Table 2: Comparative description of life quality indices of patients treated with hemodialysis and the recipients with a satisfactory function of kidney transplant

Scales	Control (n=50)	Dialysis (n=62)	Transplants (n=63)
Physical Functioning	95,3±9,7	67,4±3,4	80,2±5,8*
Role-Physical Functioning	89,4±8,7	45,4±6,3	69,4±8,8*
Bodily pain	85,2±5,4	65,5±2,5	71,3±5,3*
General Health	73,2±6,2	43,5±4,7	60,5±6,1*
Vitality	59,7±4,9	49,1±4,5	56,2±4,6*
Social Functioning	85,0±8,8	29,0±3,2	45,3±5,7*
Role-Emotional	63,1±4,9	56,5±2,5	58,7±4,3*
Mental Health	62,8±4,5	59,5±3,5	60,7±5,4

Note. * – differences between groups of dialysis and transplantation patients are statistically significant ($P < 0,05$).



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Beating Heart Minimally Invasive Mitral Valve Surgery in Patients with Previous Sternotomy: The Operative Technique and Early Outcomes

By Robert B. Xu, Mohammad Rahnnavardi, Mart Nadal, Michael Worthington,
Robert G. Stuklis & James Edwards

Summary- Objective: Re-operative mitral valve surgery is increasingly required and can be associated with significant morbidity and mortality. The beating heart minimally invasive mitral valve surgery has a proposed benefit in avoiding the risks of repeat sternotomy, with reducing the need for adhesiolysis and cardioplegia reperfusion injury. We describe our experience with such a technique in patients with previous sternotomy.

Methods: A retrospective study was performed and all patients undergoing surgery of mitral valve through a right limited thoracotomy without application of an aortic cross clamp (beating heart) as a redo cardiac surgery between January 2006 and January 2015 were included (n=25). Perioperative data as well as the operative technique are presented.

Keywords: beating heart mitral, minimal invasive mitral, redo cardiac surgery.

GJMR-I Classification: NLMC Code: WG 169



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Beating Heart Minimally Invasive Mitral Valve Surgery in Patients with Previous Sternotomy: The Operative Technique and Early Outcomes

Robert B. Xu ^α, Mohammad Rahnavardi ^σ, Mart Nadal ^ρ, Michael Worthington ^ω, Robert G. Stuklis [¥]
& James Edwards [§]

Summary- Objective: Re-operative mitral valve surgery is increasingly required and can be associated with significant morbidity and mortality. The beating heart minimally invasive mitral valve surgery has a proposed benefit in avoiding the risks of repeat sternotomy, with reducing the need for adhesiolysis and cardioplegia reperfusion injury. We describe our experience with such a technique in patients with previous sternotomy.

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Results: Six patients (24%) had two previous sternotomies and one (4%) had three previous sternotomies. Mitral valve repair was performed in 11 patients (44%). No patient required conversion to median sternotomy. Inotropic support beyond four hours after operation was required in 7 patients (28%). Ventilation time was less than 12 hours in 14 patients (56%) with another 6 patients (24%) extubated within 24 hours after surgery. Postoperative course was complicated with cerebrovascular accident in 2 patients (8%). In-hospital mortality was 4% (n=1). There was no 30-day mortality after discharge.

Conclusions: Re-operative mitral valve surgery can be safely performed through a right limited thoracotomy approach on a beating heart while on full cardiopulmonary bypass. The technique can be associated with potentially shorter operation, shorter cardiopulmonary bypass, and a less complicated recovery.

Keywords: beating heart mitral, minimal invasive mitral, redo cardiac surgery.

I. INTRODUCTION

Re-operative cardiac surgery is increasingly being performed as the population ages. Seven percent of cardiac surgeries performed in Australia between 2010 and 2011 were redo surgeries.¹ Re-entry median sternotomy is associated with significant potential morbidity and mortality, especially if patent coronary artery grafts are present.²

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Hazards during re-operative surgery include sternal re-entry with attendant risks of damage to the right ventricle, aorta, in nominate vein and patent coronary grafts. Dissection of adhesions can be time-consuming and technically challenging, especially if the aorta must be exposed for cannulation or cross-clamping. Adequate exposure of the mitral valve is also a concern with adhesions potentially limiting the ability to manipulate the heart into a position to facilitate optimum exposure. In addition, in patients with poor ventricular function, as is often seen in long-standing valvular disease or in those with a history of coronary artery disease, myocardial protection becomes a concern and cardioplegic cardiac arrest will place the patient at risk of ischemia-reperfusion injury and postoperative low cardiac output.³

The beating heart approach to mitral valve surgery was first described by Praeger and colleagues in 1989.⁴ Since then, several groups have reported good outcomes with performing mitral valve surgery on the beating heart, through a right thoracotomy.⁵⁻¹⁰ The proposed benefit of this approach is reduction in the risks of re-do sternotomy, release of adhesions and cardioplegia reperfusion injury.

We describe our experience with redo surgery for mitral valve intervention performed through a right anterolateral thoracotomy incision done on a beating heart.

II. METHODS

A retrospective study was performed and all patients undergoing surgery of mitral valve through a right anterolateral thoracotomy without application of an aortic cross clamp (beating heart) as a redo cardiac surgery between January 2006 and January 2015, in our institute, were included (n=25). Patients with previous sternotomy that merely required mitral valve intervention with no contraindication for a right thoracotomy were considered for this approach. Preoperative patient factors, perioperative outcomes, as well as complication rates were identified through retrospective database and case note review. Data was reported as mean and standard deviation, median and interquartile range (IQR), or frequency, as appropriate. Given the

retrospective nature of the study no specific local ethics committee approval was required.

a) Operative technique

All patients were intubated with a single lumen endotracheal tube. They were placed in a semi-supine position with the right chest slightly raised. External defibrillation pads were placed in all cases. Normothermic cardiopulmonary bypass (CPB) was established via femoral artery using a EOPA™ Arterial Cannula (Medtronic, Inc, MN, USA) and femoral vein using a Multi-Stage Femoral Cannula (Medtronic, Inc, MN, USA) with vacuum assist. A limited right anterolateral thoracotomy was then performed through the fourth or fifth intercostal space. A PeriVue soft tissue retractor (Edwards Lifescience LLC, Irvine, CA, USA), a rib spreader (Geister Medizintechnik, Tuttlingen, Germany), and malleable copper blade retractors were used to aid exposure. A 10-mm thoracoscopic camera was placed through a separate port placed in the third intercostal space. The pleural space was insufflated with carbon dioxide at a rate of 5 litres per minute to reduce intra-cardiac air. The aorta was not particularly dissected free, cannulated, or clamped and no cardioplegia was used.

The interatrial groove was dissected to expose the left atrium and the left atrium was directly entered after ensuring full CPB is achieved and the heart is well drained. The mitral valve was then inspected, and then replaced or repaired as appropriate based on the pathology. After the mitral valve repair or replacement has been performed, a pump sucker was kept inside the left ventricle and an agitator kept the mitral valve incompetent. Deairing was achieved by means of directly venting the left ventricle whilst the heart was filled and the atriotomy closed. Air removal was confirmed with trans-oesophageal echocardiography. A pleural drain was then placed. The patient was then weaned off CPB and de cannulated. An intercostal catheter for local anaesthetic infusion was inserted and the wounds were closed in a routine fashion.

III. RESULTS

The commonest prior cardiac surgery was coronary artery bypass grafting (n=12, 48%, Table 1). Three patients (12%) had prior mitral valve replacement. Six patients (24%) had two previous sternotomies and one (4%) had three previous sternotomies. Mitral valve repair was performed in 11 patients (44%, Table 2). Annuloplasty rings were used in all patients that had mitral valve repair. Concomitant atrial fibrillation surgery was performed in 3 (12%) patients.

No patient required conversion to median sternotomy. Weaning from CPB was successful in all patients without requiring intra-aortic balloon pump, with or without inotropic support. Inotropic support beyond four hours after operation was required in 7 patients

(28%). Ventilation time was less than 12 hours in 14 patients (56%) with another 6 patients (24%) extubated within 24 hours after surgery. Postoperative course was complicated with stroke in 1 patient (4%, Table 3) and the patient made near complete recovery with minimal deficit. Early (in-hospital) mortality was 4% (n=1). There was no mortality within the first month after discharge.

IV. DISCUSSION

Re-operative mitral valve surgery is increasingly required and carries a high burden of associated potential morbidity and mortality.⁸ Alternatives for repeat mitral surgery include redo median sternotomy and cardioplegic arrest, or hypothermic ventricular fibrillatory arrest. The technique used in the current series is similar to what has been described before by other groups.⁴⁻¹⁰ A number of advantages are described: it avoids the need for a repeat sternotomy and its associated risk of injury to cardiac structures, potential catastrophic cardiac injury, and sternal wound infection;¹¹ by limiting the degree of adhesiolysis required, through entry via a preserved right pleural space and avoiding the need for dissection around the aorta for cross-clamping, there is a potential reduction in the operative and CPB times as well as the risk of perioperative bleeding.¹² In addition, maintaining normothermia can potentially decrease the risk of coagulopathy after a complex repeat mitral surgery. The transfusion rate in this series was 40% and 2 patients (8%) required return to theatre for bleeding, both managed through reopening the right thoracotomy wound.

The alternative to the beating heart technique is a ventricular fibrillation arrest. However, ventricular fibrillation arrest is known to reduce oxygen delivery to the subendocardium, and thus provides suboptimal myocardial protection.⁸ Continuous myocardial perfusion in a beating heart technique is ideal as it provides optimal myocardial protection through maintenance of coronary circulation throughout the operation.^{13, 14}

One potential disadvantage to this technique is its perceived technical difficulty. In our experience, physiological assessment of valve repair was more easily performed with the heart beating. Indeed, the current series comprised 11 (44%) mitral valve repairs, including more complex valvuloplasties with concomitant quadrangular resection and cleft closure in addition to an annuloplasty ring. Comparable repair success rates have been previously reported.^{8, 9}

A particular concern in mitral valve surgery is air embolism,⁵ especially in this case where the aorta is not clamped and no aortic vent is placed. In our experience as well as other groups experience,⁶ with full CPB flow and vacuum assisted venous drainage, the aortic valve hardly opens even in the systolic phase, as confirmed by the intraoperative trans-oesophageal echocardiogram. Furthermore, the blood will be

preferentially expelled across the mitral valve, since atmospheric pressure is much less than the aortic root pressure.⁹After the mitral valve repair or replacement has been performed, a pump sucker is kept inside the left ventricle and an agitator keeps the mitral valve incompetent. The left atrium is allowed to fill completely with backflow of blood prior to closing the atriotomy line. Carbon dioxide insufflation is also used to displace intra-cardiac air. By avoiding aortic manipulation by a cross-clamp, the risk of systemic embolisation is potentially avoided. In this series, 2 patients had postoperative adverse neurologic events; both were felt to be embolic in aetiology.

Another potential disadvantage is a higher rate of pulmonary complications with right thoracotomy as compared with repeat median sternotomy. Indeed, our series did present a relatively high rate of pneumonia (16%).Comparable to other reports,⁸80% of patients of this series were extubated within 24 hours of surgery with a median mechanical ventilation time of 11 hours.

Although the data for all patients were collected prospectively as part of a national database, this study was limited by its retrospective design and its relative small sample size.

Re-operative mitral valve surgery can be safely performed through a right limited thoracotomy approach on a beating heart while on full CPB. The technique can potentially be associated with a shorter operation, a shorter CPB, and a less complicated recovery.

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Table 1: Patient demographics and preoperative data

Characteristics	Values
Gender (male), n (%)	15 (60)
Age, years (SD)	67.8 (10.4)
Hypertension, n (%)	14 (56)
Atrial fibrillation, n (%)	17 (68)
Pulmonary hypertension, n (%)	11 (44)
Baseline creatinine, $\mu\text{mol/L}$ (SD)	96 (44)
Chronic pulmonary disease, n (%)	4 (16)
Cerebrovascular accident, n (%)	2 (8)
Previous cardiac surgery, n (%)	

CABG	12 (48)
MV replacement	3 (12)
Open mitral commissurotomy	3 (12)
CABG and MV surgery	2 (8)
Congenital repair	2 (8)
MV repair	1 (4)
AVR	1 (4)
Aortic root replacement	1 (4)
Number of previous sternotomies, n (%)	
1	18 (72)
2	6 (24)
3	1 (4)
Mitral valve disease, n (%)	
Regurgitation	22 (88)
Stenosis	1 (4)
Mixed	2 (8)
Mitral valve pathology, n (%)	
Rheumatic	5 (20)
Myxomatous	10 (40)
Ischemic/functional	4 (16)
Annuloplasty ring/valve dehiscence	4 (16)
Failed mitral prosthesis	1 (4)
Failed previous repair	1 (4)
NYHA class, n (%)	
NYHA 1	3 (12)
NYHA 2	6 (24)
NYHA 3	9 (36)
NYHA 4	7 (28)
Left ventricular systolic function	
Preserved	17 (68)
Moderate dysfunction	8 (32)
Severe dysfunction	0 (0)

AVR, aortic valve replacement; CABG, coronary artery bypass grafting; MV, mitral valve; NYHA, New York heart association; SD, standard deviation;

Table 2: Operative and postoperative data

	Values
Type of mitral valve surgery	
Mitral valve repair	11 (44)
Mitral valve replacement	14 (56)
Cardiopulmonary bypass time, minutes (SD)	105 (41)
Ventilation time, hours, median (IQR)	11 (14)
Intensive care unit stay, days (SD), median (IQR)	2.0 (3.8)
Length of stay, median (IQR)	10 (9)
Drain output in the first 4h, mLs (SD)	494 (488)
Conversion to median sternotomy, n (%)	0 (0)

IQR, interquartile range; SD, standard deviation

Table 3: Postoperative morbidity and mortality

	n (%)
Stroke	1 (4)
Transient ischemic attack	1 (4)
Myocardial infarction	0 (0)
Return to theatre for bleeding	2 (8)
Pleural effusion requiring drainage	3 (12)
Pneumothorax	3 (12)
Pneumonia	4 (16)
Permanent pacemaker insertion	3 (12)
Postoperative transfusion	10 (40)
Wound infections	0 (0)
Intra-aortic balloon pump insertion	0 (0)
Readmission within 30 days of discharge	1 (4)
In-hospital mortality	1 (4)
Death within 30 days of discharge	0 (0)



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Transverse Ventral Island Preputial Tube Versus Double Face Preputial Tube in the Repair of Penoscrotal Hypospadias: Does the Dissection of the Tube from Dorsal Preputial Skin Affect the Outcome of Repair?

By Abdelbaset Elemam, Sami Mahjoub Taha & Mohamed Daffalla A Gismalla

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Abstract- Background: Repair of penoscrotal hypospadias is a true challenge to the surgeons. This is evidenced by the large number of procedures available for such repair. To compare transverse preputial tube with double faced tubularized penoscrotal hypospadias repairs.

Patients and Methods: A prospective, descriptive (comparative) study conducted during May 2012 to October 2015. Eighty consecutive children (age 2 to 7 years with mean age of 3.2 years) underwent single-stage repair of penoscrotal hypospadias using preputial tube. All patients fulfilling the inclusion criteria were taken as sample size. Simple random sampling was done initially to select the first type of operation then followed by the other type.

Keywords: *hypospadias, preputial tube, chordae, urethroplasty.*

GJMR-I Classification: NLMC Code: WI 955



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Results: The mean length of the neourethra in tubularized repairs was 34 mm. The follow-up ranged from 3 to 30 months (mean 14 months). The overall complication rate was 20% (16 of 80 children). Complications developed in 10 cases (25%) in group I (1 glans dehiscence, 1 penile rotation, 2 urethral strictures and 6 fistulae), while 6 of group II (15 %) who underwent double face tubularized repair developed complications (2 developed meatal stenosis, 2 urethral strictures, and 2 fistulae).

Statistical Analysis: Was used SPSS (statistical package for social science) version 20.0; Chicago, IL, USA) with p-value < 0.05 considered statistically significant.

Conclusions: Our results suggest that double face repair achieved better results with fewer complications than the transverse ventral island preputial tube.

Keywords: hypospadias, preputial tube, chordae, urethroplasty.

I. INTRODUCTION

Repair of penoscrotal hypospadias is a true challenge to the surgeons. This is evidenced by the large number of procedures available for such repair. Treatment of penoscrotal hypospadias was performed by using two stage repairs to avoid the complications such as urethral fistula formation and strictures [1]. One stage repair has the advantages of minimizing operative trauma, allowing the use of unscarred skin with good vascularity and thus decreasing number of hospitalizations. [2] The utilization of a vascularized flap as neourethral tube from the ventral aspect of the prepuce has been popularized by Duckett in 1980. [3]

When the urethral plate is adequate for utilization tubularized incised plate repair is preferable. [4] However this is not always the case especially in penoscrotal hypospadias where the surgeon finds that the urethral plate is poorly developed and unsuitable for utilization in repair after correction of chordae in many cases and preputial vascularized flap is a good alternative for repair. [5] Unfortunately, there are common problems that may occur with conventional onlay flap techniques including penile rotation and asymmetry of the penis since the vascular pedicle is brought around one side of the penis. [6]

The dissection of the preputial vascularized flap from dorsal skin has been reported to affect the vascularity of the skin which may lead to gangrene and skin loss. Hence the idea of double faced tubularized repairs appeared where the tube is transferred to the ventral aspect of the penis with its skin coverings as one unit. [7] No current evidence suggests the superiority of one surgical technique over the other. Also is still no consensus among surgeons about whether a single stage or staged procedure is the proper treatment for penoscrotal hypospadias.

Here, we present our experience with the use of transverse ventral preputial tube for single-stage penoscrotal hypospadias repair in 80 patients, and

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compare transverse island tube with double faced tubularized repairs.

II. MATERIALS AND METHODS

This was a prospective, descriptive (comparative) study conducted at Alazhar University (Al Hussain Teaching Hospital) in the period from May 2012 to October 2015, to compare transverse preputial tube with double faced tubularized penoscrotal hypospadias repairs. All patients during study period who fulfilling the criteria were included which were 80 consecutive patients with penoscrotal hypospadias who underwent single-stage repair using the prepuce. Simple random sampling was done initially to select the first type of operation then followed by the other type. The patients were divided into two groups according to the used technique. The first group (Group I) comprised 40 patients who underwent hypospadias repair using transverse ventral island preputial tube. The second group (Group II) included 40 patients who underwent double faced preputial tube (with its skin cover) repair of hypospadias. All operations were done by the same surgeon.

The subjects were limited to the patients diagnosed as penoscrotal hypospadias with extensive chordae more than 30 degree after surgical degloving of the penis, who underwent one of the surgical techniques (Group one and two) and on regular follow-up. The exclusion criteria were: Patients with other types of hypospadias (distal and shaft), operation done by other surgeon or junior staff, penoscrotal hypospadias with straight or less than 30 degrees curved penis after degloving and if the patient disappeared or not on regular follow-up.

The surgical technique and patient follow-up: All procedures were performed under general anesthesia and loupe magnification after signing written informed consent by the parents. Surgical steps were started by circumferential coronal incision extending proximally by two vertical incisions 6-8 mm apart along the urethral plate up to the external urethral meatus and then going around the urethral meatus then degloving of the penis down to its root and proceeding to the correction of chordae assessed by artificial erection. All patients had extensive chordae more than 30 degree after complete penile degloving, excision of the fibrotic urethral plate and the dysplastic corpus spongiosum allow straightening of the penis. Glanular wings were fashioned and the length of ventral preputial flap needed was measured and outlined. In group I, the ventral preputial tube was fashioned to allow easy passage of 10 F. Nelaton's catheter, then the tube was completely designed with its pedicle then separated from preputial and dorsal skin of the penis and corpora by dissection plane developed between the flap and the dorsal skin, down to the base of the penis. The neourethral tube was

rotated to the ventral surface of the penis from the left side and fixed to the corpora at its suture line. The stitches knots were kept outside the lumen of the neourethra (*Figure 1*). In patients of group II wide flap was required to make tabularization easier around a 8 F. Nelaton's catheter. Great care was taken to preserve the vascular pedicle of the flap. The tube was then transposed ventrally within its dorsal preputial skin and sutured to the corpora without any penile rotation using two interrupted suture (5/0 vicryl) (*Figure 2*). In both groups, the tube was sutured to proximal urethra using interrupted suture (6/0 vicryl), the original meatus was spatulated to make wide proximal anastomosis then the stent was put in the neourethra and sutured to the glans. Glanuloplasty was performed with two or more 5/0 vicryl sutures. The neomeatus is made oval. In group I, the rest of the preputial tissue was used for ventral penile coverings, while in group II the skin over the tube was sutured to remaining skin on both lateral sides by 5/0 vicryl suture. The stent was fixed to the glans by 4/0 vicryl suture, and then it was left into the diaper for two weeks. Post-operative antibiotics, analgesics, and antispasmodics are given. Dressing was removed after one week and the penis was kept moist with antibiotic ointment. The patients were discharged from the hospital after one or two days, to be followed in outpatient clinic. Follow up assessment was made after one month and 3 months by uroflowmetry.

Statistical Analysis: Data was collected using a data collecting sheet (annexes). All statistical analyses were performed using SPSS (statistical package for social science) version 20.0; Chicago, IL, USA) with p-value < 0.05 considered statistically significant. Our institutional ethical review board approved the study.

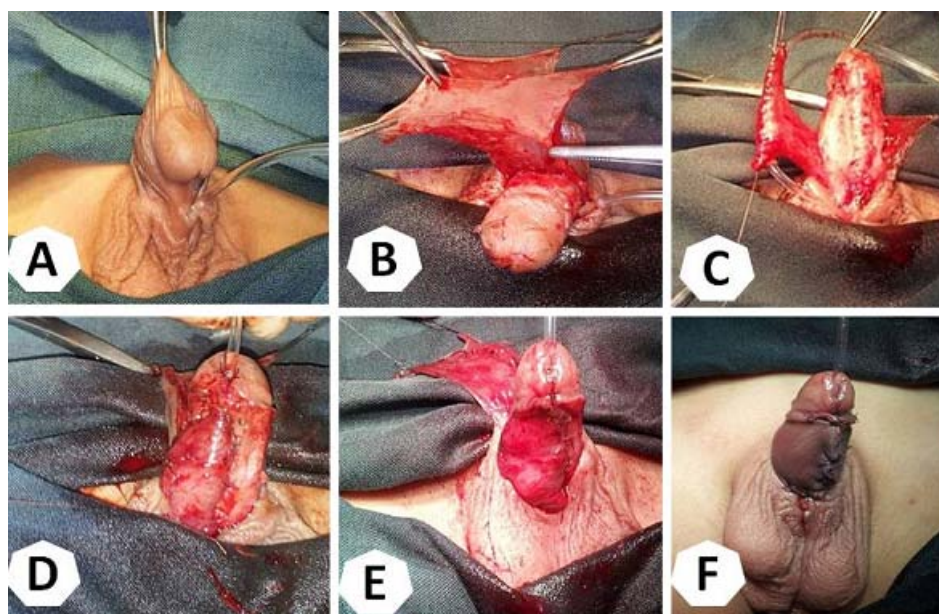


Figure 1: Transverse preputial island onlay tube (Duckett). A, Penoscrotal hypospadias with severe chordae. B, The flap is dissected from dorsal skin. C, The flap is tubed around the stent. D, the tube is transferred ventrally and anastomosed to the native urethra. E, The dorsal skin is ready to be brought ventrally to the base of the flap. F, The repair is completed.

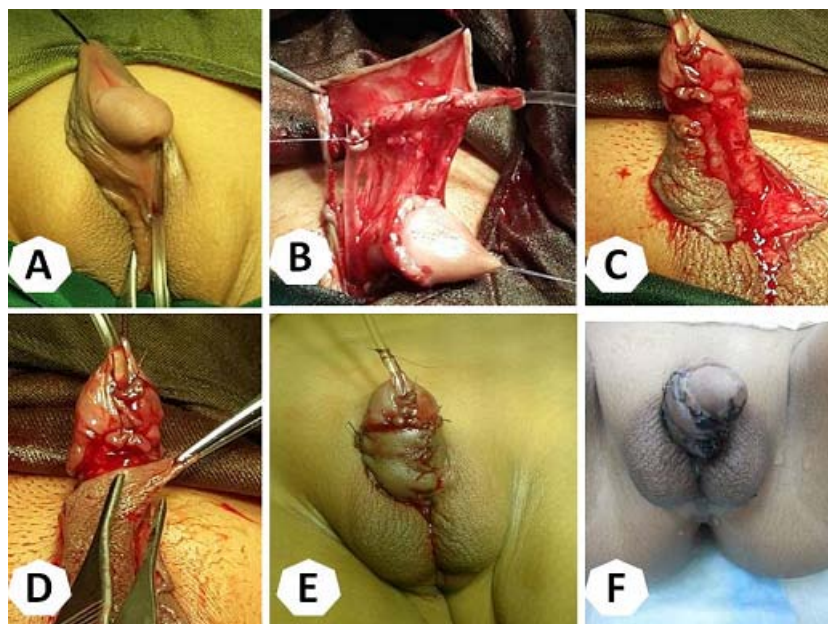


Figure 2: Double Face Duckett repair. A, Penoscrotal hypospadias with severe chordae. B, Preputial tube left attached to dorsal penile skin. C, The tube is anastomosed to the native urethra. D, Skin coverage is performed at ease. E, completed procedure. F, During follow up with good cosmetic result.

III. RESULTS

This study was a prospective, descriptive study conducted at Alazhar University (Al Hussain Teaching Hospital) in the period from May 2012 to October 2015, 80 consecutive children (age 2 to 7 years with mean age of 3.2 years) underwent single-stage repair of penoscrotal hypospadias using preputial tube. All of them underwent urethral plate excision because it was

rudimentary or unsuitable for utilization in repair. In Group I (40 children) hypospadias was corrected by transverse ventral island preputial tube. In Group II (40 children), double faced preputial tube (with its skin cover) repair was performed. The mean length of the neourethra in tubularized repairs was 34 mm. The follow-up ranged from 3 to 30 months (mean 14 months) (*Table 2*).

The overall complication rate was 20 % (16 of 80 children) (*Table 2*). Complications developed in 10 cases (25%) in group I (1 glans dehiscence, 1 penile rotation, 2 urethral strictures and 6 fistulae), while 6 of group II (15%) who underwent double face tubularized repair developed complications (2 developed meatal stenosis, 2 urethral strictures, and 2 fistulae). The difference between the complication rates in both group was statistically significant ($p= 0.001$). The 8 children underwent fistula repair at a second operation and was successful in seven. The remaining one children with fistula (from group I) developed recurrence of the fistula and lost to follow up. The parents of the child with penile rotation refused the second operation. The child with glans dehiscence was treated successfully in a second repair. Meatal stenosis was managed by meatotomy in one and meatoplasty in another case. Two children with urethral strictures were treated successfully by anastomotic urethroplasty. Another two children with urethral strictures were lost to follow up. After management of the complications 76 of 80 children (95%) had good urine flow with satisfactory cosmetic result. Uroflow studies were performed in 76 children and showed normal curves and normal flow rates.

IV. DISCUSSION

The increasing number of procedures involved in hypospadias repair in the literature indicates that none of such procedures is ideal for all cases and the reconstructive technique should be tailored according to the type of hypospadias, the availability of the urethral plate, the state of circumcision, the state of penile skin and the degree of chordae. In the presence of good urethral plate, it should be utilized in the reconstruction since many studies found that preservation of urethral plate led to a high success rate repair with minimal complications. [8-10] However, in the presence of severe chordae, as in cases of penoscrotal hypospadias, the urethral plate may be rudimentary or unsuitable for utilization in the repair after excision of the chordae and need complete transection to allow proper penile straightening. The alternatives to the urethral plate include: the prepuce, penile skin or buccal mucosa. [11]

Several surgical techniques have been designed for penoscrotal hypospadias repair as one stage or staged procedures. The staged technique was found simple and safe; however, the need for another hospital admission and anesthesia with additional costs limit the use of staged procedures. The one-stage repair is gaining more popularity by many surgeons recently because of its high success rate and comparable safety but still there are high complication rates that may necessitate another intervention. [12]

The problem with penoscrotal hypospadias repair is the need for reconstruction of the deficient urethra and penile skin. The prepuce presents a good

substitute for both the urethra and penile covering. Transverse preputial island tube urethroplasty has been reported to be more reliable than free tube operations, whether skin [13-15] or bladder mucosa. [16]

In the present study, we performed a one-stage procedure using two established techniques to repair penoscrotal hypospadias in 80 cases with significant chordae more than 30 degrees categorized into two groups (40 cases each). The first group underwent transverse island tube procedure. The second group underwent double face repair of hypospadias. In fact, our aim was to try to answer the question: Does the dissection of the vascularized tube from dorsal preputial skin affect the outcome of the repair? Final outcome was satisfactory in 76 of 80 children (95%) (All cases except two urethral strictures, one fistula and one penile rotation) which is comparable to the results of Hayashi and coworkers (2001). [17]

The overall complication rate in the present study was 20 % (16 of 80 children). The complication rate for group I was 25% and for group II 15% which was statistically significant ($p= 0.001$). This suggests that the dissection of the vascularized pedicle tube from dorsal preputial tissue may affect the vascularity and increase the complication rate and also shows that transferring the tube with its skin covering appears to achieve better results.

Duckett reported complication rates ranging from 7.5% to 18%. [18,19] Subsequent studies reported higher postoperative complications of one-stage Duckett urethroplasty, the rate varying from 8.6% to 56%. [20-22] The complication rate in our study was 20%, lies in that range. Another study with larger number of patients is needed to give more accurate success rates. Nuhoglu and associates (2006) suggested that the complication rate can be lowered by proper skin care before surgery, tension free anastomosis, fine tissue handling, minimizing the use of electrocautery, the use of fine instruments with optimal magnification as well as the administration of prophylactic antibiotic as long as the catheters are in place. [23]

In our study as well as in others urethrocutaneous fistula was the most common complication which can be minimized by avoiding tissue ischemia, closing the tube in two different layers invaginating the epithelium inward and covering the new urethra and the anastomosis site with adequate tissue before skin closure. [21] The additional coverage of the tunica vaginalis or scrotal dartos on the neourethral ventral side significantly decreased the risk of urethrocutaneous fistula, while also making phalloplasty safer and easier because of the additional coverage. [24] This technique has previously been applied in hypospadias surgery with excellent results. [25-26] Risk factors for complications include the following: Severity of hypospadias, the situation of the urethral plate, the patient (age, endocrine environment etc), the procedure

and surgeon experience[22] despite Zhonghua et al (2011) mentioned no significant difference in the rate of complication among either different age groups or different surgical times[27]. Hayashi et al (2001) attributed their low complication rate (7.7%) due to not only the two-layer closure of the neourethra but also the wrapping of the proximal anastomosing site with corpus spongiosum tissue. [17]

There is much controversy whether to use suprapubic drainage or urethral catheterization for urinary diversion. Demirbilek and Atayurt (1997) found that the Duckett procedure without suprapubic diversion had two or three times higher complication rates than those with suprapubic diversion. [24]

Chuang and Shieh (1995) reported no significant difference in the complication rate between the two diversions, but still preferred suprapubic diversion to an indwelling urethral catheter as disruption of the suture lines may occur during removal of the silicone Foley catheter.[25] In the current study, we did not employ suprapubic urinary diversion because it is thought to cause more bladder spasms than urethral catheterization. [15] We put a small caliber (6-8 Fr) Nelaton's catheter as a stent reaching the bladder fixed by the stay suture in the glans during the operation and we cut it to drain in a diaper. We have not experienced any complications related to this type of drainage.

Results of hypospadias repair can be analyzed using objective and subjective criteria. Objective criteria include functional evaluation of micturition. Uroflowmetry is difficult to interpret as its profile is often abnormal even if reconstruction is satisfactory. These flat profiles often reflect the poor compliance of the reconstructed urethra or the abnormal bladder behavior after hypospadias surgery. Subjective criteria are more difficult to define and evaluate in children, but certainly include cosmetic appearance, psychosocial adjustment, and body image.[26]

The mean length of the reconstructed urethra in our study was 34 mm (range: 20 to 54 mm) which is similar to that previously reported (Hayashi et al.[17]-33.7 mm, Sorber et al. [27]-34.6 mm, Chuang and Shieh[28] -30 mm). It has been mentioned that patients with a neourethra less than 3 cm in length had significantly less complications than those with a neourethra longer than 3 cm[29]. We found that true, and 15 out of the 16 patients who developed complications had neourethra longer than 3 cm

The preputial pedicle tube has been reported to have cosmetic disadvantages such as ventral bulkiness from the pedicle and penile rotation⁽²⁷⁾. [30] However, we had pleasing cosmetic results without bulking of the penile shaft. This is in agreement with the results of Hayashi et al.⁽¹⁷⁾. We had significant penile torsion in one child but his parents refused another corrective surgery. We used buttonhole technique in group I to

bring dorsal skin to cover the ventral aspect of the penis to avoid penile torsion.

The first limitation in this study is the small number of cases in each group which makes statistical analysis inconclusive. This low number of cases is due to the fact that in many cases we find a satisfactory urethral plate that we can use for repair and such cases were excluded from the present series. The second limitation is the short-term follow up since it has been reported that more than 30% of posterior hypospadias patients develop complex long-term problems⁽²⁸⁾. [31] However, since the purpose of the report is to evaluate the outcome of the preputial tube with and without dissection of the dorsal skin and skin necrosis occurs immediately after surgery, we believe that 14 months is a sufficient time to evaluate the outcome of the flap and skin.

V. CONCLUSION

Transverse preputial island tube and double face repair are good options to reconstruct proximal hypospadias after excision of chordee and urethral plate. Our results suggest that the dissection of the vascularized pedicled tube from dorsal preputial tissue may affect the vascularity and increase the complication rate and also shows that transferring the tube with its skin covering appears to achieve better results.

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TABLES

Table 1: Transverse ventral island preputial tube versus double face preputial tube in the repair of penoscrotal hypospadias: Mean age, length of neourethra and follow up in the studied 80children

Parameter	Mean (range)	Group I (n=40)	Group II (n=40)	P value
Mean age	3.2 years (2-7)	2.8	3.1	0.36
Mean length of neourethra	34 mm (20 - 54)	32.7 mm (20 -49)	33 mm(25 - 54)	0.51
Mean follow-up	14 months (3to30)	13.5(6-30)	15.5(3-27)	0.08

Table 2: Transverse ventral island preputial tube versus double face preputial tube in the repair of penoscrotal hypospadias: Complications in the studied population

Complications	Group I (n=40)	Group II (n=40)	P value
Urethrocutaneous fistula	6	2	0.003
Urethral stricture	2	2	0.71
Glanular dehiscence	1	0	0.001
Meatal stenosis	0	2	0.004
Penile rotation	1	0	–
Total 16 (20%)	10 (25%)	6 (15 %)	0.001



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Outcome of Gastroschisis in a Developing Country: Where to Focus?

By Md. Samiul Hasan, Kazi Md Noor-ul Ferdous, Abdul Aziz, Ayub Ali
& Proshanto Kumar Biswas

Abstract- Background: Gastroschisis is a common congenital anterior abdominal wall defect. With the advancement of neonatal care outcome of gastroschisis is improving worldwide but the result is disappointing in our center. Several factors adversely affect the outcome. The aim of this study was to identify the factors influencing the adverse outcome and where to focus to improve the situation.

Materials and methods: It was a retrospective analytical study done in Dhaka Shishu (Children) Hospital from March 2014 to April 2017. Data were collected from hospital record. All patients admitted with gastroschisis during the study period were included and grouped into A (survived) and B (expired). Factors influencing the outcome were compared between two groups. Statistical analysis was done using SPSS version 22.

Results: Out of 75 neonates 43 were male and 32 were female. Only 14 patients survived (18.7%). Prenatal diagnosis was done in only 3 patients. Mean gestational age, mean birth weight & mean time from delivery to surgery between two groups found statistically significant. Type of surgery was also found significantly affecting outcome.

Keywords: *gastroschisis, silo repair.*

GJMR-I Classification: *NLMC Code: WI 900*



OUTCOME OF GASTROSCHISIS IN A DEVELOPING COUNTRY WHERE TO FOCUS?

Strictly as per the compliance and regulations of:



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Outcome of Gastroschisis in a Developing Country: Where to Focus?

Md. Samiul Hasan ^α, Kazi Md Noor-ul Ferdous ^σ, Abdul Aziz ^ρ, Ayub Ali ^ω & Proshanto Kumar Biswas [¥]

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Conclusion: Awareness regarding prenatal diagnosis & planning of delivery should be developed. Intensive perinatal care and earliest possible surgery are the key factor for better outcome in gastroschisis.

Keywords: gastroschisis, silo repair.

I. INTRODUCTION

Gastroschisis is a congenital defect in the anterior abdominal wall right to the umbilical cord resulting from incomplete closure of the lateral folds during sixth weeks of gestation¹. As a result the small bowel and other viscera are exposed to amniotic fluid until delivery and to environment after. Incidence varies from 1 in 4000 to 1 in 10000 live birth² and this is increasing world wide⁸. In contrast to omphalocele associated anomalies are infrequent³. The outcome of neonates with gastroschisis has improved over past decades. Though most series claims survival rates over 90%^{4,5,6}, our experience is still frustrating. Several factors are associated with adverse outcome in gastroschisis, including prematurity, low birth weight, absence of

prenatal diagnosis, place of delivery, timing of repair, type of repair, associated anomaly and sepsis^{5, 6}. The aim of this study was to evaluate the outcome and identify the factors influencing the outcome and how to address these factors to improve outcome in gastroschisis in a tertiary care pediatric surgery center of Bangladesh.

II. MATERIALS AND METHODS

It was a retrospective analytical study done in Dhaka Shishu (Children) Hospital from March 2014 to April 2017. Hospital records of all patients with gastroschisis were reviewed. Immediately after admission, exposed viscera (photograph 1) were covered with plastic bag (photograph 2). Patients were covered with cotton sheet, kept nothing per oral; an 8Fr feeding tube was inserted for nasogastric suction. Intravenous fluid resuscitation and antibiotic started immediately. All patients received injection vitamin K. Investigations performed on admission were blood grouping and Rh typing, random plasma sugar, serum electrolytes. After initial resuscitation patients were taken to Operation Theater and reposition & primary repair tried under general anaesthesia (photograph 3). When reposition was not possible, silo was performed with sterile saline bag or urobag (photograph 4). After operation patients kept nothing per oral, NG suction and intravenous nutrition maintained until abdominal distention reduced & bowel movement established. Silo was squeezed every alternate day and repair performed when complete reposition was possible. Neonates were divided into two groups. Group A (Neonates who survived), Group B (Neonates who expired). Data were collected regarding prenatal diagnosis, gestational age, birth weight, place of delivery, associated anomaly, time from delivery to surgery and final outcome. Ethical clearance was taken from hospital ethical committee. Statistical analysis was done using SPSS Version 22 software. Associations of continuous data were assessed using student t- test. Associations of categorical data were assessed using Chi-square test and Fisher's exact test. For both test, p<0.05 was considered significant.

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Photograph 1: Exposed edematous viscera



Photograph 2: Initial covering with plastic bag



Photograph 3: Primary repair



Photograph 4: Silo formation

III. RESULTS

Out of 75 neonates admitted during the study period, 43 were male and 32 were female (figure 5). Only 14 patients survived (18.7%). Prenatal diagnosis was done in only 3 patients among whom 2 patients survived. Mean gestational age was 35.71 ± 1.06 weeks in group A and 34.34 ± 1.42 weeks in group B. This difference was statistically significant. Mean birth weight was 2.19 ± 0.14 kg in group A and 2.00 ± 0.20 kg in

group B. Eight patients out of 14 in group A were delivered within Dhaka division in group A and only 18 patients out of 61 in group B were delivered within Dhaka division. Six patients had associated intestinal atresia, all of them expired. Mean time from delivery to surgery in group A was 13.14 ± 2.41 hours and in group B was 18.75 ± 3.86 hours. Silo performed in 40 patients. Among them only one survived. Thirty five patients had primary repair of which 13 survived (table 1).

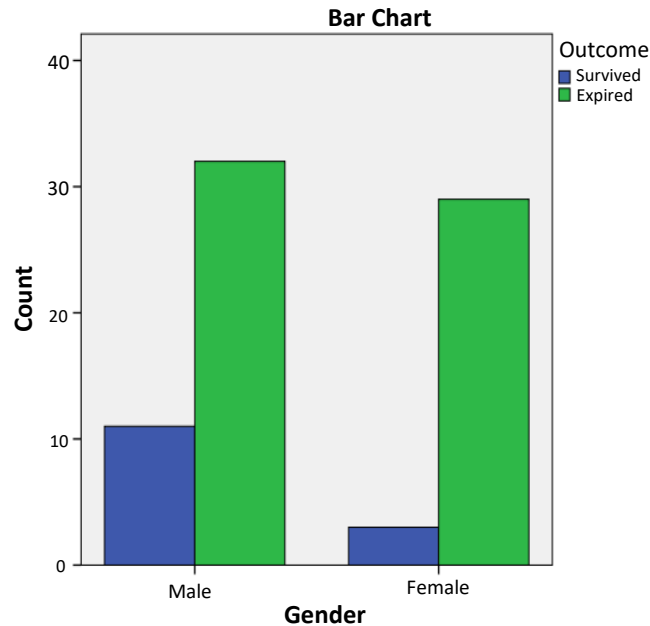


Figure 5: Gender distribution between survived & expired group

Table 1: Factors influencing outcome of gastroschisis

Factors	Group A: Survived (n=14)	Group B: Expired (n =61)	P value
Prenatal diagnosis	2	1	
Mean gestational age (weeks)	35.71±1.06	34.34±1.42	.001
Mean birth weight (kg)	2.19±0.14	2.00±0.20	.001
Place of delivery	within Dhaka= 8 Outside Dhaka=6	Within Dhaka=18 Outside Dhaka= 43	
Mean time from delivery to surgery (hour)	13.14±2.41	18.75±3.86	.001
Intestinal atresia	1	5	
Type of surgery	Repair=13, Silo=1	Repair=22, Silo=39	.001

IV. DISCUSSION

Pediatric surgery division of Dhaka Shishu (Children) Hospital is the largest tertiary care pediatric surgery center in Bangladesh. With limited resource we are continuously trying to improve our service. When it comes to gastroschisis, we are still struggling. So, we tried to find out where to focus.

We found more male patients than female in this study. Owen A et al. found same⁷ but Bradnock T J et al found opposite⁸. According to Klein M D gastroschisis occur predominantly in male but definite explanation yet to found³.

Prenatal diagnosis is believed to improve outcome in gastroschisis by optimizing time, place and mode of delivery. In most reported studies prenatal diagnosis significantly affected outcome^{2,6,8}. But we found only 4% (3/75) patient with prenatal diagnosis. This is due to less public awareness about prenatal care & screening in a developing country like Bangladesh. Limited experience of radiologists and primary care giver at rural area might also be a contributing factor. In advanced centers prenatally diagnosed cases are delivered in regional centers and after delivery, herniated bowel immediately placed in plastic bag to prevent hypothermia and hypovolemia⁶. Quirk J G et al demanded resuscitation and stabilization of neonates with gastroschisis by an experienced team of neonatologists. Advantages include the prevention of hypothermia, hypovolemia and assurance of nasogastric drainage².

Quirk J G et al showed delivery in the regional center is associated with the better outcome². We found same result. This is due to early transport and closure of the defect. Fasching G et al & Quirk J G et al reported no significant difference in outcome with mode of delivery^{2, 11}. Time from delivery to surgery is crucial. In this study we found huge difference with most reported studies. Most authors urges earliest possible repair of gastroschisis and they do it within 5 hours of delivery². In our center it is much delayed as most of the babies come from outside Dhaka. When we received the neonates the exposed viscera were already swollen and

edematous and patients were in severe hypovolemia & hypothermia. It further delays the surgery and made reposition very difficult. Hence silo was performed in most patients though primary repair is treatment of choice^{5,6}. Several studies reported better outcome using preformed silo^{4,7}. We used sterile saline bag or urobag to form a silo. Almost all of this patients developed sepsis & were associated with poor outcome.

Mean gestational age & birth weight was significantly higher in survivor group. This finding is similar to most of the series^{4, 5, 6, 8}. Fasching G et al however showed gestational age has no influence on outcome. This is because of advanced neonatal intensive care (NICU) and nutritional support⁹. In our center NICU support is not always available for these babies and it is very difficult to manage these premature low birth weight babies in ward. Most of them suffer from hypothermia, sepsis and acidosis. Watanabe et al & Calcagnotto et al reported low birth weight in gastroschisis as a factor for increased mortality^{9,10}.

Intestinal atresia is another poor prognostic factor in neonates with gastroschisis. In this series we found 83.33% mortality (5/6). Driver et al & Snyder et al reported increased morbidity but not mortality in these cases^{5,6}. This is may be due to advanced NICU support & facilities for prolonged parenteral nutrition, which are not available in our setup.

V. CONCLUSION

Factors adversely influence the outcome are absence of prenatal diagnosis & planning of delivery, prematurity & low birth weight, associated intestinal atresia and duration from delivery to surgery. Immediate resuscitation & covering of exposed viscera after delivery is also of great importance. Efforts must continue to raise awareness among general people as well as among obstetricians to increase prenatal diagnosis and to instruct newborn care providers in peripheral hospitals in the appropriate initial care of these high risk neonates. Neonatal surgical intensive care is a crucial factor as almost all neonates are premature.

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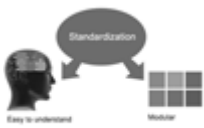
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