Diabetologia publishes reports of clinical and experimental work on all aspects of diabetes research and related subjects, provided they have scientific merit and present important facts or new data. Invited Reviews and Editorials are also published. Rapid communications of results with immediate interest may also be considered for expedited publication. Mere confirmation of known facts will be accepted only in exceptional cases; the same applies to reports of experiments and observations having no positive outcome. The Editor in Chief will be pleased to consider for publication papers read at meetings of the European Association for the Study of Diabetes, provided that they meet the above requirements. Letters to the Editor commenting on previously published work in Diabetologia, and Workshop reports are also welcome. It should be noted that there are no page charges with the exception of Workshop reports.

Manuscripts (5 copies) should be sent to:
Professor C. Hellerström
Editor-in-Chief
Diabetologia
Department of Medical Cell Biology
Biomedicum, Box 571
S-75123 Uppsala
Sweden

Copyright
Submission of a manuscript implies: that the work described has not been published before (except in the form of an abstract); that it is not under consideration for publication elsewhere; that its publication has been approved by all co-authors, if any, as well as by the responsible authorities at the institute where the work has been carried out; that, if and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the publisher and that the manuscript will not be published elsewhere in any language without the consent of the copyright holders.

All articles published in this journal are protected by copyright, which covers the exclusive rights to reproduce and distribute the article (e.g., as offprints), as well as all translation rights. No material published in this journal may be reproduced photographically or stored on microfilm, in electronic data bases, video disks, etc., without first obtaining written permission from the publisher.

The use of general descriptive names, trade names, trademarks, etc., in this publication, even if not specifically identified, does not imply that these names are not protected by the relevant laws and regulations.

While the advice and information in this journal is believed to be true and accurate at the date of its going to press, neither the authors, the editors, nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Special regulations for photocopies in the USA. Photocopies may be made for personal or in-house use beyond the limitations stipulated under Section 107 or 108 of U.S. Copyright Law, provided a fee is paid. This fee is US$ 0.20 per page per copy, plus a basic fee of US$ 2.00 per article. All fees should be paid to the Copyright Clearance Center, Inc., 21 Congress Street, Salem, MA 01970, USA, stating the ISSN 0012-186X, the volume, and the first and last page numbers of each article copied. The copyright owner's consent does not include copying for general distribution, promotion, new works, or resale. In these cases, specific written permission must first be obtained from the publisher.

This journal is included in the ADONIS service, whereby copies of individual articles can be printed out from compact discs (CD-ROM) on demand. To help people requesting articles from participating ADONIS centres we have develop- ed the ADONIS identification System which provides every article, etc., with a separate unique number. This ADONIS number can then be used to order a document. The number appears at the top left-hand corner of the first page of each article. An explanatory leaflet giving further details of the scheme is available from the publishers on request.

Subscription information

All other countries: Recommended annual subscription rate: DM 528.– plus carriage charges; [Federal Republic of Germany: DM 24.40 incl. value added tax; all other countries: DM 34.80 except for the following countries to which SAL delivery (Surface Airmail Lifted) is mandatory: Japan DM 99.60, India DM 70.80, Australia/New Zealand DM 115.20. Airmail delivery to all other countries is available upon request). Volume price: DM 528.–, single issue price: DM 52.80 plus carriage charges. Orders can either be placed via a bookdealer or sent directly to: Springer-Verlag, Heidelberger Platz 3, 1000 Berlin 33, FRG, Tel. (0) 30/ 8207-1, Telex 183319, FAX (0) 30/8214091. Members of the European Association for the Study of Diabetes, the American Diabetes Association and the International Diabetes Federation are entitled to reduced rates. Please inquire about them with the publisher.

Changes of address: Allow six weeks for all changes to become effective. All communications should include both old and new addresses with postal codes and should be accompanied by a mailing label from a recent issue.

Back volumes: Prices are available on request.

Microform: Microform editions are available from: University Microfilms International, 300 N. Zeeb Road, Ann Arbor, MI 48106, USA

Production
Springer-Verlag
Journal Production Department I
Postfach 105280
W-6900 Heidelberg 1
Federal Republic of Germany
Tel. 06221/ 487-431, Telex 04-61723
FAX (0) 6221/487624

Responsible for advertisements
Springer-Verlag GmbH & Co KG
Kerstin Schilling
Heidelberger Platz 3
1000 Berlin 33
Federal Republic of Germany
Tel. 030/ 8207-1-740, Telex 01-85411
FAX (0) 30/8207300

Printers
Druckhaus Beltz
W-6944 Hemsbach/Bergstraße
Federal Republic of Germany
© Springer-Verlag Berlin Heidelberg 1991
Springer-Verlag GmbH & Co KG
1000 Berlin 33, Federal Republic of Germany
Printed in Germany
Contents

Outcome of pancreatic transplantation

M. Olausson, G. Nyberg, G. Nordén, B. Frisk, L. Hedman
Outcome of pancreatic transplantsations in Göteborg, Sweden 1985–1990  S 1

A. Königsrainer, W. Steurer, C. Aichberger, R. Gassner, Th. Schmid, R. Margreiter
Pancreatic transplantation with delayed duct occlusion versus bladder drainage: long-term results  S 4

X. Martin, N. Lefrancois, J.M. Marechal, A. Gelet, J.L. Viguier, J.M. Dubernard
Pancreas transplantation in Lyon: overall results  S 8

Pancreas and kidney transplantation: the San Raffaele Hospital, (Milan, Italy) experience  S 11

W.-D. Illner, D. Abendroth, J. Nusser, R. Landgraf, W. Land
Long-term results in pancreatic transplantation with special emphasis on the use of prolamine  S 14

G. Hillebrand, W.-D. Illner, D. Abendroth, H. Schneeberger, I. Petry, S. Schleibner, R. Landgraf, W. Land
Outcome of renal grafts after simultaneous kidney/pancreas transplantation  S 16

I.B. Brekke
Indications and results of pancreatic transplantation: the Oslo experience 1983–1990  S 18

G. Tydén, A. Tibell, J. Bolinder, J. Östman, C.-G. Groth
The Stockholm experience with pancreatic transplantation using enteric exocrine diversion  S 21

U.T. Hopt, M. Büsing, W.D. Schareck, H.D. Becker
The bladder drainage technique in pancreas transplantation: the Tübingen experience  S 24

D.E.R. Sutherland
Report from the International Pancreas Transplant Registry  S 28

Metabolic and hormonal control

E. Esmatjes, L. Fernández-Cruz, M.J. Ricart, R. Casamitjana, M.A. López-Boado, E. Astudillo
Metabolic characteristics in patients with long-term pancreas graft with systemic or portal venous drainage  S 40

G. Nyberg, G. Fager, L. Mjörnstedt, M. Olausson
Metabolic risk factors for cardiovascular disease in pancreas and kidney transplant recipients  S 44

Long-term follow-up of glycaemic control and parameters of lipid transport after pancreas transplantation  S 47

Metabolic control after kidney and pancreas transplantation: whole series results and effects of segmental duct obstruction versus whole pancreas with bladder diversion technique  S 51

A. Secchi, S. Martinenghi, R. Caldara, E. La Rocca, V. Di Carlo, G. Pozza
First peak insulin release after intravenous glucose and arginine is maintained for up to 3 years after segmental pancreas transplantation  S 53

R.P. Robertson, P. Diem, D.E.R. Sutherland
Time-related, cross-sectional and prospective follow-up of pancreatic endocrine function after pancreas allograft transplantation in Type 1 (insulin-dependent) diabetic patients  S 57

R. Landgraf, J. Nusser, R.L. Riepl, F. Fiedler, W.-D. Illner, D. Abendroth, W. Land
Metabolic and hormonal studies of Type 1 (insulin-dependent) diabetic patients after successful pancreas and kidney transplantation  S 61

Long-term metabolic control in recipients of combined pancreas and kidney transplants  S 68

F. Saudek, T. Pelikánová, V. Bartoš, I. Reneltová, L. Kazdová, J. Kovář, L. Karasová
Insulin action and insulin binding following pancreas transplantation  S 71

J. Bolinder, G. Tydén, A. Tibell, C.-G. Groth, J. Östmann
Long-term metabolic control after pancreatic transplantation with enteric exocrine diversion  S 76

Consequences of systemic venous drainage and denervation of heterotopic pancreatic transplants for insulin/C-peptide profiles in the basal state and after oral glucose

Retinopathy

A. Königsrainer, K. Miller, W. Steurer, G. Kieselbach, C. Aichberger, D. Öfner, R. Margreiter
Does pancreas transplantation influence the course of diabetic retinopathy?  S 86

Ophthalmological follow-up of Type 1 (insulin-dependent) diabetic patients after kidney and pancreas transplantation  S 89

F. Bandello, C. Vigano, A. Secchi, S. Martinenghi, R. Caldara, V. Di Carlo, G. Pozza, R. Brancato
Effect of pancreas transplantation on diabetic retinopathy: a 20-case report  S 92

A. Scheider, E. Meyer-Schwickerath, J. Nusser, W. Land, R. Landgraf
Diabetic retinopathy and pancreas transplantation: a 3-year follow-up  S 95

Neuropathy

C. Vial, X. Martin, N. Lefrancois, J.M. Dubernard, F. Chauvin, B. Bady
Sequential electrodiagnostic evaluation of diabetic neuropathy after combined pancreatic and renal transplantation  S 100

Neuropathological study of the effect of combined kidney and pancreas transplantation on diabetic neuropathy: a 2-year follow-up evaluation  S 103

X. Navarro, W.R. Kennedy, D.E.R. Sutherland
Autonomic neuropathy and survival in diabetes mellitus: effects of pancreas transplantation  S 108

W. Müller-Felber, R. Landgraf, St. Wagner, N. Mair, J. Nusser, M.M.C. Landgraf-Leurs, A. Abendroth, W.-D. Illner, W. Land
Follow-up of sensory-motor polyneuropathy in Type 1 (insulin-dependent) diabetic subjects after simultaneous pancreas and kidney transplantation and after graft rejection  S 113

Effect of pancreatic and/or renal transplantation on diabetic autonomic neuropathy  S 118

Macro- and microcirculation

G. Nyberg, O. Bech-Hanssen, M. Olausson, I. Wallentin
Echocardiographic findings in kidney transplanted Type 1 (insulin-dependent) diabetic patients with and without a pancreas transplant  S 100

D. Abendroth, J. Schmand, R. Landgraf, W.-D. Illner, W. Land
Diabetic microangiopathy in Type 1 (insulin-dependent) diabetic patients after successful pancreatic and kidney or solitary kidney transplantation  S 103

G. Jörneskog, G. Tydén, J. Bolinder, B. Fagrell
Skin microvascular reactivity in fingers of diabetic patients after combined kidney and pancreas transplantation  S 106

Quality of life

P.S. Zehr, F.K. Milde, L.K. Hart, R.J. Corry
Pancreas transplantation: assessing secondary complications and life quality  S 110

A. Secchi, V. Di Carlo, S. Martinenghi, E. La Rocca, R. Caldara, D. Spotti, G. Slaviero, C. Staudacher, G. Ferrari, G. Pozza
Effect of pancreas transplantation on life expectancy, kidney function and quality of life in uraemic Type 1 (insulin-dependent) diabetic patients  S 113

C.L. Zehrer, C.R. Gross
Quality of life of pancreas transplant recipients  S 118

P. Bouček, V. Bartoš, I. Vaněk, Z. Hýža, J. Skibová
Diabetic autonomic neuropathy after pancreas and kidney transplantation  S 120

G. Solders, G. Tydén, A. Persson, C.-G. Groth
Improvement in diabetic neuropathy 4 years after successful pancreatic and renal transplantation  S 122

Quality of life in Type 1 (insulin-dependent) diabetic patients prior to and after pancreas and kidney transplantation in relation to organ function  S 125

Ø.H. Bentdal, P. Fauchald, I.B. Brekke, H. Holdaas, A. Hartmann
Rehabilitation and quality of life in diabetic patients after successful pancreas-kidney transplantation  S 128
Quality of life in Type 1 (insulin-dependent) diabetic patients prior to and after pancreas and kidney transplantation in relation to organ function


1 Department of Internal Medicine “Innenstadt”, 2 Transplantation Center, 3 Institute for Medical Psychology, University of Munich, Munich, FRG

Summary. Improvement of the quality of life in Type 1 (insulin-dependent) diabetic patients with severe late complications is one of the main goals of pancreas and/or kidney grafting. To assess the influences of these treatment modalities on the different aspects of the quality of life a cross-sectional study in 157 patients was conducted. They were categorized into patients pre-transplant without dialysis (n = 29; Group A), pre-transplant under dialysis (n = 44; Group B), post-transplant with pancreas and kidney functioning (n = 31; Group C), post-transplant with functioning kidney, but insulin therapy (n = 29; Group D), post-transplant under dialysis and insulin therapy again (n = 15; Group E) and patients after single pancreas transplantation and rejection, with good renal function, but insulin therapy (n = 9; Group F). All patients answered a mailed, self-administered questionnaire (217 questions) consisting of a broad spectrum of rehabilitation criteria. The results indicate a better quality of life in Groups C and D as compared to the other groups. In general the scores are highest in C, but without any significant difference to D. Impressive significant differences between C or D and the other groups were found especially in their satisfaction with physical capacity, leisure-time activities or the overall quality of life. The satisfaction with the latter is highest in C (mean ± SEM: 4.0 ± 0.2 on a 1 to 5 - rating scale; significantly different from A: 3.1 ± 0.1, B: 2.7 ± 0.2 and E: 2.6 ± 0.3; p < 0.01), followed by D (3.8 ± 0.2; significantly different from B and E; p < 0.01). Group F shows a mean of 3.1 ± 0.4, which is not significantly different from C. The percentages of patients in each group, who are not working: A: 38 %, B: 64 %, C: 74 %, D: 66 %, E: 87 % and F: 78 % indicate that there is no marked improvement in the vocational situation after successful grafting.

Key words: Diabetes mellitus - Pancreas transplantation - Kidney transplantation - Quality of life - Rehabilitation

Introduction

Quality of life assessment is important not only with regard to medical but also in socio-economic aspects. This is true especially for expensive and incisive therapeutic regimens which aim to prolong life (Najman & Levine 1981). In surgery there is a trend towards measuring physical and psychosocial effects of interventions (Wood-Dauphinee & Troidl 1986; O’Young & McPeek 1987; Troidl et al. 1987; Wood-Dauphinee & Troidl 1989; Koostra in press; Neugebauer et al. in press) and this has recently also been voiced with respect to transplantation (Kaplan De-Nour & Shanan 1980; Evans et al. 1985; Andrykowski et al. 1987; Hart & Evans 1987; Nakache et al. 1989; Vorugati & Sells 1989; Muthny et al. 1990; Corry & Zehr 1990; Johnson et al. 1990; Bullinger et al. 1991; Kemkes in press). So far there is little information as to how pancreatic grafting affects the quality of life in patients with longstanding diabetes. Preliminary data (Nakache et al. 1989; Vorugati & Sells 1989; Corry & Zehr 1990; Johnson et al. 1990) and clinical experiences from many centres suggest however that pancreas transplantation can improve many aspects of the physical and psychosocial well-being of diabetic individuals with severe secondary complications. There is some disagreement on how to measure quality of life (Derogatis 1975; Guyatt et al. 1986; Bremer & McCauley 1986; Leighton et al. 1987; McDowell & Newell 1987; Wood-Dauphinee & Williams 1987; Patrick & Erickson 1988; Walker & Rosser 1988; Aaronson in press). Some authors prefer structured inpatient interviews, some an evaluation by the physician, and others use home-based questionnaires. Using a mailed self-administered questionnaire this study describes for the first time a detailed cross-sectional analysis of the quality of life of patients after successful kidney and/or pancreas transplantation compared with diabetic subjects with or without dialysis treatment prior to transplantation, patients after failure of the kidney, the pancreas or both organs.
Subjects and methods

Subjects. The patient sample consisted of 157 Type 1 (insulin-dependent) diabetic subjects with severe late complications, who had either received a pancreas and/or kidney transplantation between 1979 and 1989 or were on the waiting list for transplantation. Important data of the patients analyzed are listed in detail in Table 1. There were no statistical significant differences between the groups except for a younger age of group F patients.

Methods. The study was designed as a cross-sectional analysis using a patient-based questionnaire, which is a modified version of an instrument previously administered to renal transplant recipients (Muthny et al. 1990). It contains 6 relevant components of quality of life (Fig.1), consisting of 217 questions, most of them to be rated with a score system from 1 to 5, representing for example "very dissatisfied" (1), "dissatisfied" (2), "neither-nor" (3), "satisfied" (4) or "very satisfied" (5). Additionally 59 questions on somatic complaints potentially present in type 1 diabetics with a long duration of their disease and secondary complications were introduced. Fifteen sum scores concerning physical and emotional situation or leisure-time activities were calculated, which have been tested for internal consistency (Cronbach’s alpha). For evaluation of the emotional situation two of the nine SCL-90-R subscales, anxiety (10 items) and depression (13 items), all items rated from 1 (not at all) to 5 (very strong) were applied, additionally both a positive and a negative emotions scale. Since some patients left questions uncompleted, sum score values were divided by the number of answered items provided that more than 70% of the items had been filled in. Moreover open questions for the patients’ coping with their pre- or postoperative situation and on socio-economic aspects like age, sex, number of children, education or vocational situation were included.

Statistical analysis. All data are presented as mean ± SEM for scales or frequencies for questions. For statistical analysis of intergroup differences the Student’s t-test with Bonferroni adjustment for multiple testing was used. Relationships between the different subscales and the overall quality of life were analyzed via Spearman correlation coefficients. Multiple regression analysis was used to determine the variables contributing most strongly to the overall quality of life.

Results

Leisure-time activities and social contact

The means for the satisfaction with leisure-time activities and number of friends for all groups are presented in Figure 2. There were significant differences between

### Table 1. Clinical data of the patient sample consisting of 157 Type 1 (insulin-dependent) diabetic subjects

<table>
<thead>
<tr>
<th>Group</th>
<th>Sex (f/m)</th>
<th>Age (years)</th>
<th>Duration of diabetes (years)</th>
<th>Time on dialysis pretransplant (months)</th>
<th>Time since transplantation (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>14/15</td>
<td>32.7 ± 1.3</td>
<td>22.7 ± 1.2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>17/27</td>
<td>35.2 ± 1.2</td>
<td>22.1 ± 1.0</td>
<td>28.8 ± 3.1</td>
<td>7 - 117</td>
</tr>
<tr>
<td>C</td>
<td>17/14</td>
<td>38.4 ± 1.6</td>
<td>26.6 ± 1.1</td>
<td>24.8 ± 3.5</td>
<td>27.0 ± 4.3</td>
</tr>
<tr>
<td>D</td>
<td>18/11</td>
<td>37.2 ± 1.4</td>
<td>25.3 ± 1.6</td>
<td>29.4 ± 5.5</td>
<td>33.7 ± 4.0</td>
</tr>
<tr>
<td>E</td>
<td>7/8</td>
<td>38.6 ± 2.1</td>
<td>27.2 ± 1.6</td>
<td>24.3 ± 5.9</td>
<td>43.1 ± 7.6</td>
</tr>
<tr>
<td>F</td>
<td>6/3</td>
<td>28.1 ± 1.6</td>
<td>a</td>
<td>22.7 ± 1.6</td>
<td>27.1 ± 6.7</td>
</tr>
</tbody>
</table>

* x numbers represent mean, SEM and range
* a patients in group F significantly (p < 0.05) younger than in groups C, D and E
groups C (significantly different from B; p < 0.01 and E; p < 0.05) or D (significantly different from B; p < 0.05) and the other groups with respect to their satisfaction with leisure time activities. High percentages in groups C (55%) and D (55%) were "satisfied" and "very satisfied" with these activities in contrast to the other groups (20 to 32%). More patients in group C (74%) and D (72%) were "satisfied" or "very satisfied" with the number of friends compared to the other groups (ranging from 45 to 62%). Transplantation-related changes in recreational activities are listed in Table 2.

Fig. 2. Mean scores of different patient groups concerning satisfaction with leisure-time activities and number of friends. The six score columns per question represent from left to right: □ Group A: pre-transplant without dialysis, □ Group B: pre-transplant under dialysis, □ Group C: post-transplant, pancreas and kidney functioning, □ Group D: post-transplant, kidney functioning, but insulin therapy, □ Group E: post-transplant under dialysis and insulin therapy and □ Group F: after single pancreas grafting and rejection, own kidney functioning. * p < 0.05; **p < 0.01

Table 2. Percentages of the patients in each post-transplant group giving the answers "more" and "much more" for changes in the following aspects of leisure-time activities from the pre- to the posttransplant period. For further details see legend to Figure 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holidays</td>
<td>35</td>
<td>52</td>
<td>7</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sports</td>
<td>52</td>
<td>41</td>
<td>13</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultural life</td>
<td>32</td>
<td>52</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being among people</td>
<td>74</td>
<td>59</td>
<td>13</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hobbies</td>
<td>45</td>
<td>38</td>
<td>13</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Vocational situation

The mean scores of satisfaction with the vocational situation (Fig. 3) are highest in C (significantly different from B; p < 0.01), followed by A (significantly different from B; p < 0.05) and D. The lowest scores were seen in patients on dialysis awaiting transplantation. The satisfaction with the financial situation is very similar in A, C and D, without any significant difference to the lower scores in the other groups. When analyzing the more detailed information given by the patient, the vocational situation seems not to improve substantially after successful transplantation (Table 3). Asked for the reasons for not working, mainly the present health status (even in C and D), fears about medical complications, other tasks like taking care for the family or simply the satisfaction with the disability pension (26% in C) were given. Less important were problems in connection with the general job situation. The actual rate of unemployment in Germany is 8-15%.

Fig. 3. Mean scores of satisfaction with vocational and financial situation. For further details see legend to Figure 2.

Table 3. Vocational situation in the different groups (percentages of the patients in each group). For details see legend to Figure 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not working</td>
<td>38</td>
<td>64</td>
<td>74</td>
<td>66</td>
<td>87</td>
<td>78</td>
</tr>
<tr>
<td>Disability</td>
<td>24</td>
<td>48</td>
<td>68</td>
<td>55</td>
<td>53</td>
<td>33</td>
</tr>
<tr>
<td>Scholar / student</td>
<td>10</td>
<td>9</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>22</td>
</tr>
</tbody>
</table>

Partnership, sexual and family life

The satisfaction with partnership and family life were highest in C, followed by D, but also comparatively high in the other groups without significant differences between the groups (Fig. 4). Satisfaction with sexual activity is highest in D and significantly different only to B (p < 0.05). More information about interpersonal relationships is given in Table 4.
Table 4. Social support and sexuality in the different groups (percentages of the patients in each group). See legend to Figure 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living together with others</td>
<td>69</td>
<td>75</td>
<td>84</td>
<td>69</td>
<td>80</td>
<td>44</td>
</tr>
<tr>
<td>Stable partnership</td>
<td>66</td>
<td>50</td>
<td>81</td>
<td>69</td>
<td>60</td>
<td>44</td>
</tr>
<tr>
<td>Married</td>
<td>52</td>
<td>52</td>
<td>74</td>
<td>62</td>
<td>60</td>
<td>22</td>
</tr>
<tr>
<td>No sexual activity during last month</td>
<td>24</td>
<td>48</td>
<td>32</td>
<td>24</td>
<td>40</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 5. Means ± SEM of all items belonging to the primary diabetic symptoms (9 items), the symptoms of angiopathy (9 items), peripheral neuropathy (9 items), autonomic neuropathy (12 items), nephropathy (11 items) and retinopathy (2 items). These different item lists have been tested for internal consistency using the Cronbach's alpha coefficient (mentioned below).

<table>
<thead>
<tr>
<th>Group</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary diabetic symptoms (alpha = 0.68)</td>
<td>2.0 ± 0.11</td>
<td>2.4 ± 0.07</td>
<td>1.8 ± 0.12</td>
<td>2.1 ± 0.14</td>
<td>2.3 ± 0.23</td>
<td>2.3 ± 0.26</td>
</tr>
<tr>
<td>Angiopathy symptoms (alpha = 0.62)</td>
<td>1.5 ± 0.08</td>
<td>1.6 ± 0.07</td>
<td>1.4 ± 0.08</td>
<td>1.5 ± 0.08</td>
<td>1.7 ± 0.22</td>
<td>1.6 ± 0.17</td>
</tr>
<tr>
<td>Peripheral neuropathy symptoms (alpha = 0.88)</td>
<td>1.8 ± 0.13</td>
<td>2.3 ± 0.15</td>
<td>1.7 ± 0.12</td>
<td>1.9 ± 0.16</td>
<td>2.0 ± 0.28</td>
<td>2.1 ± 0.40</td>
</tr>
<tr>
<td>Autonomic neuropathy symptoms (alpha = 0.80)</td>
<td>1.8 ± 0.10</td>
<td>1.9 ± 0.10</td>
<td>1.8 ± 0.10</td>
<td>1.7 ± 0.09</td>
<td>1.8 ± 0.25</td>
<td>2.2 ± 0.25</td>
</tr>
<tr>
<td>Nephropathy symptoms (alpha = 0.86)</td>
<td>1.5 ± 0.09</td>
<td>2.3 ± 0.11</td>
<td>2.1 ± 0.14</td>
<td>2.2 ± 0.13</td>
<td>2.4 ± 0.24</td>
<td>1.7 ± 0.35</td>
</tr>
<tr>
<td>Retinopathy</td>
<td>3.2 ± 0.23</td>
<td>3.0 ± 0.19</td>
<td>2.4 ± 0.22</td>
<td>2.7 ± 0.31</td>
<td>2.8 ± 0.37</td>
<td>3.7 ± 0.50</td>
</tr>
</tbody>
</table>

* group B significant different from C; p < 0.01

Physical and mental status

The satisfaction with the physical capacity was highest in C and differed significantly from B (p < 0.01) and E (p < 0.05). It is followed by D, which was significantly different from B (p < 0.05; Fig. 5). However, when asked about a reduced physical capacity, many patients in C and D also feel impaired (79% in A, 82% in B, 58% in C, 66% in D, 87% in E and 44% in F). While all groups were comparable in their problems with wound healing (intergroup range 55 to 64%), they showed differences especially in hypoglycaemic episodes (Table 6). Table 5 gives six sum scores concerning diabetic secondary complications. Only small differences appear across groups with the exception of primary diabetic symptoms (Group C significantly different from B; p < 0.01; see...
also Table 6) and retinopathy symptoms (differences not significant). The satisfaction with mental capacity is best in C, but not significantly different from the other groups (Fig. 5). Many patients in all groups have problems in concentrating or remembering (see again Table 6). The patients in Group F could not be analyzed for the last items because several answers were missing.

Table 6. Percentages of the patients in each group suffering from physical and mental symptoms. For details see legend to Figure 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polydipsia</td>
<td>62</td>
<td>84</td>
<td>22</td>
<td>41</td>
<td>60</td>
<td>56</td>
</tr>
<tr>
<td>Hypoglycaemia</td>
<td>83</td>
<td>75</td>
<td>29</td>
<td>83</td>
<td>73</td>
<td>89</td>
</tr>
<tr>
<td>Problems in concentrating</td>
<td>41</td>
<td>68</td>
<td>55</td>
<td>73</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>Problems in remembering</td>
<td>38</td>
<td>68</td>
<td>42</td>
<td>73</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

Impairment by treatment and medication

Pre- and post-transplant dialysis patients (B and E) feel most impaired by regular visits to physicians (B significantly more than A; p < 0.01) and dietary restrictions. Group C also complains of the latter, probably due to body weight problems originating from continuous steroid medication and well-being. The differences between all groups concerning the fears of adverse drug side effects are negligible (Fig.6). In Groups C and D the fears of drug side effects are mostly related to steroids and cyclosporine, in both dialysis groups to antihypertensive drugs. The percentages of post-transplant hospitalisation were 58% in C, mostly because of rejection episodes, urinary tract infections and hypertension, 59% in D, mainly due to urinary tract infections and rejection episodes, 87% in E and 66% in F, mostly because of rejection episodes. During the previous year 45% of patients in A stayed in hospital due to eye problems, gastrointestinal symptoms and insulin adaption problems. In the same period 61% of Group B patients needed hospital care, mostly because of insulin adaption difficulties, problems with angiopathy or hypertension, haemorrhages and gastrointestinal complaints.

Emotional situation

The mean scores of SCL-90-R anxiety and depression subscales are shown in Figure 7. Symptoms of anxiety are lower in C and D than in the other groups without reaching significance, symptoms of depression are lowest in C (significantly different from B; p < 0.01) followed by D. The mean scores of the positive emotions (7 items like optimism, energy or self consciousness) show the best emotional situation in C (significantly better than E, p < 0.01). Asked about fears for rejection, 25% of group C patients report that these are "frequent" and "very frequent" ("sometimes" in 39%, "rare" and "never" in 36%) while 20% of Group D patients state frequent fears ("sometimes": 62%, "rare" and "never": 14%).

Overall quality of life

Group C and D both reported a much higher satisfaction with their present overall quality of life when compared to the other groups. The scores of Group C were significantly different (p < 0.01) from A, B and E; those of D were significantly different (p < 0.01) from B and E (Fig.8). The distribution of the five possible answers to the question in each group (Fig.9) showed that 74% of all patients in C and 69% in D were "satisfied" or "very satisfied" with their overall quality of life, whereas 65% in A, 61% in B, 60% in E and 66% in F answered "dissatisfied" or "neither-nor".

![Fig.6](image-url)  
**Fig.6.** Mean scores of impairment by regular visits to physicians, dietary restrictions and fears for adverse drug side effects. For further details see legend to Figure 2. *p < 0.05; **p < 0.01

![Fig.7](image-url)  
**Fig.7.** Mean scores of SCL-90-R subscales anxiety and depression and the positive emotions scale. For further details see legend to Figure 2. *p < 0.05; **p < 0.01

![Fig.8](image-url)  
**Fig.8.** Mean scores of overall quality of life among patients in each group. For further details see legend to Figure 2. *p < 0.05; **p < 0.01

![Fig.9](image-url)  
**Fig.9.** Distribution of the five possible answers to the question in each group. For further details see legend to Figure 2. *p < 0.05; **p < 0.01
Fig. 8. Mean scores of satisfaction with the present overall quality of life. For further details see legend to Figure 2. *p < 0.05; **p < 0.01

Fig. 9. Distribution of answers concerning satisfaction with the overall quality of life. For further details see legend to Figure 2.

Relationships between overall quality of life and subcomponents

The highest Spearman correlation coefficients between the overall quality of life and different aspects are listed in Table 7. There was no significant correlation with age, sex, duration of diabetes, place and way of living (alone or with others).

In a further step multiple linear regression was used to evaluate the most important factors influencing the overall quality of life. The nine items were included as predictors, which showed high Spearman correlation coefficients when correlated to the overall quality of life: physical capacity ($r = 0.69$), leisure time activities ($r = 0.64$), positive emotions ($r = 0.63$), coping with treatment ($r = 0.60$), sexual activities ($r = 0.53$), vocational situation ($r = 0.49$), family life ($r = 0.49$), number of friends ($r = 0.45$) and financial situation ($r = 0.34$). The multiple linear regression yielded a R-square of 0.70. This means that the overall quality of life is described rather well by these nine items, which reflect the six main components of the basic concept (Fig. 1).

| Table 7. Spearman correlation coefficients between the present overall quality of life and different components of quality of life. Each p < 0.01 |
|-----------------|------------------|
| Aspects of quality of life | Correlation coefficient (r) |
| Physical capacity | 0.70 |
| Coping with treatment | 0.63 |
| Positive emotions | 0.62 |
| Leisure time activities | 0.61 |
| Sexual activities | 0.54 |
| Vocational situation | 0.52 |
| Depression symptoms | 0.48 |
| Family life | 0.47 |
| Number of friends | 0.43 |
| Financial situation | 0.39 |
| Partner relationship | 0.36 |
| Mental capacity | 0.34 |

Discussion

The present study investigated the quality of life of diabetic patients with regard to the benefits of a combined pancreas and kidney transplantation.

Results showed that both post-transplant groups with functioning pancreas and kidney or a kidney only rated their quality of life higher than the pre-transplant groups before or under dialysis and the post-transplant groups after complete rejection of both organs. This was observed not only in the overall rating but also in quality of life components, especially depression, leisure-time activities, physical capacity and sexual activities.

Poor results however were found with respect to vocational situation. Similar results have been reported in a multicentre study in Germany with non-diabetic kidney transplant recipients (Muthny et al. 1990). Of all post-transplant patients with a functioning kidney only 38% are working. Better results were obtained in other countries. The percentages of working patients post-transplant were 65% after combined pancreas-kidney grafting or 68% after kidney transplantation, both in diabetics (Nakache et al. 1989) and 74% in non-diabetic subjects after renal transplantation (Evans et al. 1985). The reasons for this difference are not clear and cannot be attributed to our health care and social system since in Sweden with a comparable socio-economic structure the vocational situation after grafting is much better (Nakache et al. 1989).

The data suggest that successful pancreas and/or kidney transplantation is associated with an improved quality of life (Evans et al. 1985; Nakache et al. 1989; Vorugati & Sells 1989; Corry & Zehr 1990; Johnson et al. 1990). An additional functioning pancreas leads to an even better quality of life when compared to kidney recipients only, although these further improvements are not seen in all aspects of quality of life. Similar results have been reported recently (Nakache et al. 1989; Corry & Zehr 1990; Johnson et al. 1990).
Positive effects of transplantation have been published also in heart transplant patients (Bullinger et al. 1991; Kemkes in press), non-diabetic renal transplant recipients (Kaplan De-Nour & Muthny et al. 1990) and bone marrow recipients (Andrykowski 1987).

Even though such results are promising with regard to the benefits of transplantation, they are based on cross-sectional studies, which suffer from potential sample / selection biases and time/generation effects. Further research should make use of prospective designs which in spite of randomization problems will provide a more appropriate account of the changes in quality of life due to transplantation.

The possibility to obtain the patient’s account of his/her knowledge about the instruments, their unavailability in a certain language and also the uncertainty as to how disease- and treatment-specific a tool should be. The questionnaire used in this study follows the disease-specific approach (DCCT Research Group 1988). It does not represent a standard tool, but by including questions of special relevance to the patient group, it might add to the pool of information about the therapeutic alternatives in this disease. The development of a specific complaint list in this study represents a step toward a disease-specific and standardized assessment.

Finally the present study supports a multidimensional conceptualization of quality of life. Although global assessments are useful, subtle differences between treatments can only be distinguished using subscales, which assess relevant components of the quality of life concept.

With this strategy, the evaluation of outcomes can be fine-tuned so that a careful weighing of advantages and disadvantages of grafting becomes transparent and open for discussion. This has implications not only for clinical evaluation research but also for health political aspects of organ transplantation.

Acknowledgments: We thank Professors F. A. Muthny and U. Koch, Institute for Rehabilitation Psychology, University of Freiburg, for allowing us to modify their questionnaire and providing methodical information. We also wish to acknowledge the support of Mrs. Beranek, Department of Internal Medicine “Innenstadt”, for helping in the statistical evaluation and Mrs. Haag for the illustrations.

References

Bullinger M. Quality of life - methodologist’s view. Theoretical Surgery, in press.
Kemkes BM. Quality of life issues in heart transplantation. Theoretical Surgery, in press.
Koostra G. Quality of life issues in renal surgery. Theoretical Surgery, in press
practice of research strategies for surgical investigators. Springer, New York, pp 53-68

Dr. W. Piehlmeier
Professor R. Landgraf
Klinikum Innenstadt
Medizinische Klinik
University of Munich
Ziemssenstr. 1
8000 Munich 2
FRG
Author Index

Aanstoot, H.-J. 388, A98
Abdel-Halim, S.M. 302, A76
Abendroth, D. 195, A49
Abinader, J. 627, A157
Abu, E.A. 508, A128
Adams, J.E. 155, A39
Adelantado, J.M. 797, A200
Adezati, L. 262, A66
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B. 258, A65
Adlerberth, A. 276, A70
Adojaan, B. 258, A65
Adoyan, B. 706, A177
Ämmälä, C. 346, A87
Ämmälä, C. 342, A86
Aerts, L. 369, A93
Agardh, C.-D. 746, A93
Ahmed, S. 468, A118
Adojaan, B.
Zachariadis, D. 240, A61
Zaidi, K.F. 247, A62
Zamaklar, M. 296, A75
Zamaklar, M. 673, A169
Zambelli, L. 567, A142
Zancanaro, C. 469, A118
Zandomeneghi, R. 774, A194
Zandomeneghi, R. 775, A194
Zandomeneghi, R. 776, A195
Zanette, G. 39, A10
Zangl, W. 577, A145
Zavaroni, I. 75, A19
Zecchi, A. 262, A66
Zekorn, T. 675, A169
Zellenrath, P. 598, A150
Zenere, M. 74, A19
Zenere, M. 239, A60
Zenobi, P.D. 771, A193
Zenobi, P.D. 772, A194
Zenti, M.G. 567, A142
Zerbini, G. 91, A23
Zerbini, G. 268, A68
Zerbini, G. 532, A134
Zerbini, G. 538, A135
Zhang, A. 360, A91
Zhang, F. 416, A105
Zhang, Z. 460, A116
Ziegler, A.G. 223, A56
Ziegler, A.G. 408, A103
Ziegler, A.G. 758, A190
Ziegler, B. 315, A79
Ziegler, B. 383, A96
Ziegler, D. 146, A37
Ziegler, D. 233, A59
Ziegler, M. 314, A79
Ziegler, M. 315, A79
Ziegler, M. 319, A80
Ziegler, M. 383, A96
Ziegler, O. 455, A135
Ziegler, R. 175, A44
Zierath, J.R. 43, A11
Zilli, F. 634, A159
Zilli, L. 113, A29
Zimmermann, U. 675, A169
Zink, S. 139, A35
Ziora, D. 29, A8
Zolli, M. 510, A128
Zoppitelli, P. 210, A53
Zoppitelli, P. 317, A80
Zoppo, A. 91, A23
Zoppo, A. 551, A138
Zouali, H. 393, A99
Zühlke, H. 313, A79
Zumsteg, U. 377, A95
Zweers, E.J.K. 791, A198
Zwick, H. 618, A155