Eur Arch Psychiatry Clin Neurosci (2007) 257:344–351 DOI 10.1007/s00406-007-0737-z

ORIGINAL PAPER

Alexander Diehl · Bernhard Croissant · Anil Batra · Götz Mundle · Helmut Nakovics · Karl Mann

Alcoholism in women: is it different in onset and outcome compared to men?

Received: 18 September 2006 / Accepted: 26 February 2007 / Published online: 14 July 2007

Abstract Onset and course of alcohol dependence show gender related differences (telescoping effect) suggesting that women are more vulnerable to chronic alcohol consumption. This raises the question whether the differences are associated with a different treatment outcome as well. We hypothesized, that alcohol dependent women with a telescoping course show a less favourable treatment outcome compared to men. We investigated 212 alcohol dependent patients; matching 106 consecutively admitted women with 106 men drawn from a total sample of 343 male patients. The treatment program consisted of a 6 week inpatient treatment and 12 months of outpatient aftercare. We assessed milestone variables in development and course of alcoholism and carried out standardized diagnostic tests, physical and blood examinations to evaluate the course of the disease and treatment outcome. Overall, we confirm the telescoping effect, a faster progression in the course of alcoholism (developmental events and adverse consequences) in women compared to men ("telescoping effect"). However, despite the telescoping effect treatment outcome was similar in women and men. During the inpatient treatment program no alcohol relapse occurred. Throughout the 12 months outpatient treatment we found no significant differences in the survival analysis between women (283.29 ± 11.26 days) and men (284.72 ± 12.16 days). At the end of the 12 months both groups had an abstinence rate of approximately 50% and a drop-out rate of 33%.

Key words alcohol · gender · outcome · predictors · women

A. Diehl · B. Croissant · H. Nakovics · K. Mann (✉)
Dept. of Addictive Behavior and Addiction Medicine
Central Institute of Mental Health, Mannheim
University of Heidelberg
J5
68159 Mannheim, Germany
Tel.: +49-621/1703-3502
Fax: +49-621/1703-3505
E-Mail: sucht@zi-mannheim.de

A. Batra · G. Mundle
Dept. of Psychiatry and Psychotherapy
University Hospital of Tuebingen
Osianderstrasse 24
72076 Tuebingen, Germany

EAPCN 737

Introduction

Course of alcoholism

Women suffering from alcohol dependence are thought to show different patterns of alcohol exposure and a different course of the disease compared to men. Women are likely to start their alcohol consumption at a later age (Chou and Dawson 1994; Gomberg 1993) and show a lower average amount of alcohol consumption than do men (Olenick and Chalmers 1991; Ross 1989). Alcohol dependent women have been reported to enter treatment at a similar age as men despite showing shorter periods of alcohol consumption or alcohol dependence (Bucholz et al. 1992; Ross et al. 1988). The fact that women enter treatment after a shorter period of alcohol dependence may not be related to the disease itself, but may instead rather be due to a general gender specific utilisation of health care services. Even though gender differences in alcohol use and treatment patterns are influenced by social factors, there are also biological gender differences which play a role. The average woman weighs less than the average man, stores less body water and is said to have lower levels of gastric mucosal alcohol metabolizing-enzymes (Frezza et al. 1990). This results in higher blood alcohol levels compared to men even when consuming the same amount of alcoholic beverages or even less (Jones and Jones 1976) and endures after controlling for differences in body weight and body water (Ammon et al. 1996). While some studies failed

to show any major differences between women and men concerning the course of alcoholism (Schuckit et al. 1998; York and Welte 1994), several studies indicate that female alcoholics experience a faster progression of the developmental events leading to dependence ("telescoping effect") and an earlier onset of adverse consequences of alcoholism (Ashley et al. 1977; Hesselbrock et al. 1985; Johnson et al. 2005).

Consequences of alcoholism

There is evidence for a faster development of alcoholic cirrhosis (Loft et al. 1987; Pequignot et al. 1974), greater effects on skeletal or cardiac muscle (Fernandez-Sola et al. 1997; Urbano-Marquez et al. 1995), an accelerated brain atrophy (Hommer et al. 1996; Hommer et al. 2001; Mann et al. 1992; Mann et al. 2005) and an earlier onset of cognitive deficits in female compared to male alcoholics (Acker 1986), although there are a few studies negating this effect (Hanna et al. 1992, Pfefferbaum et al. 2001; Rabinovitz et al. 1989; Seppa and Sillanaukee 1994).

Treatment outcome

The telescoping course of alcoholism and the earlier onset of adverse consequences of alcoholism indicate that women are more vulnerable to chronic alcohol consumption. Based on this observation one might hypothesize that the less favourable course of alcoholism in women is also linked with a less favourable treatment outcome. Contrary to this assumption, however, several studies concerning gender differences in alcoholism actually reported better treatment outcome in female alcoholics (Project MATCH Research Group 1997; Sanchez-Craig et al. 1991; Timko et al. 2002) although in the largest of those studies this difference was no longer noticeable after a 3 year follow-up period (Project MATCH Research Group 1998). Foster et al. and O'Connor et al. found no significant gender differences in the treatment outcome of alcoholics (Foster et al. 2000; O'Connor et al. 1993). More recent studies on alcoholism treatment outcome found the female sex to be a predictor for relapse in an outpatient sample (Bottlender and Soyka 2005) and overall a slightly less favourable outcome for percent days abstinent in women in the large "Combine Study" on combined pharmacotherapies and behavioural interventions (Anton et al. 2006). Reviews of alcohol research indicate that in the majority of studies on gender related differences in treatment outcome these differences were small and derived from a heterogeneous sample of studies (Ballesteros et al., 2004; Jarvis 1992). Differences in the definition of treatment outcome, period of time to follow up and matching client characteristics complicate the comparison and interpretation of the data.

Objective of the study

The present study evaluates whether gender-related differences in onset and course of alcoholism also affect treatment outcome. The knowledge of these gender-related aspects of alcoholism could have implications on our understanding of the mechanisms of the disease and might help to identify subgroups with different treatment needs and strategies.

Methods

The study was performed within the project "Long-term course and relapse-prevention in alcohol-dependent women and men", funded by the Federal Ministry of Education and Research in Germany (BMBF).

Setting

The university hospital draws from an urban and suburban area in the southwest of Germany. The inpatient treatment unit for alcohol disorders accepts all alcohol dependent patients living in the vicinity. The treatment program consists of a 6 week inpatient treatment involving group therapy, individual treatment sessions with elements of behavioural therapy, occupational therapy, and psychotherapeutic relaxation techniques. Psycho-education and role-playing with training of coping skills are implemented with an emphasis on relapse prevention. The inpatient treatment program requires a total of 30h per week. Inpatient treatment is then followed by an outpatient aftercare program with weekly group sessions for one year (Mann and Batra 1993).

Subjects

The master sample (n = 454) consisted of 111 women and 343 men admitted consecutively to the inpatient unit. Of the 111 women five discontinued inpatient treatment within 3 days against medical advice. The remaining 106 women were examined along with 106 men from our master sample who had been matched by age and education. All subjects met DSM IV and ICD 10 criteria for alcohol dependence and eligibility criteria. Inclusion criteria: alcohol as the principal drug of abuse; minimum age of 18. Exclusion criteria: past or current dependence on drugs other than alcohol or tobacco; schizophrenia, bipolar or major depressive disorder; a current or chronic medical or neurological illness. All subjects provided written, informed consent before participation in the protocol, which had been reviewed by the Institutional Review Board and had therefore been performed in accordance with ethical standards laid down in the 1964 Declaration of Helsinki.

Procedure

To determine gender-related differences in onset and treatment outcome of alcoholism, we examined alcohol dependent women and men at the beginning and at the end of the inpatient period (immediately before discharge) using standardized diagnostic tests as well as physical examination and laboratory tests. Within the 12 month outpatient follow-up period abstinence was assessed once a week by alcohol breathalyzer, physicians' rating as well as patients' self report. Significant others were involved in the inpatient treatment phase and asked to report any drinking of the patients throughout the outpatient year. Additionally we randomly analyzed serum ethanol. All patients underwent detailed clinical evaluation that included detailed medical history, demographic history, and assessment of current and former addictive behaviour.

Our assessment of patients' addictive behaviour was performed by means of a structured interview with proven reliability and validity (Mann et al. 1995). This assessment included onset and chronological sequence of the milestone events in the development of alcoholism ("first drink", "first intoxication", "continuous consumption", "onset of dependence" and "first inpatient treatment") and onset of the somatic, mental, and social consequences of alcoholism. Each patient underwent a physical examination, blood and urine tests, Beck's Depression Inventory (BDI) measuring characteristic attitudes and symptoms of depression (Beck and Beamesderfer 1974), an assessment of verbal intelligence (MWT-B) in order to determine premorbid intelligence (Lehrl et al. 1995), a German-language adaptation of the Stockwell "Severity of Alcohol Dependence Questionnaire, SADQ" (Stockwell et al. 1979), and the "Global Assessment of Functioning" (GAF) scale to rate psychological, social, and occupational functioning of adults on a hypothetical continuum of mental health-illness (DSM-IV 1996).

Definition of outcome criteria

"Abstinence" was defined as no subjective report or objective indication of alcohol consumption for the entire previous period of observation. "Relapse" was defined as any alcohol consumption. The outcome criteria refer to both the inpatient treatment period and the outpatient follow-up period. For inpatient treatment any discharge of up to four days earlier and later than the defined six weeks was handled as regular inpatient treatment completion. During outpatient follow-up any drop-outs were handled as relapse. The study's end point was the time elapsed before first alcohol consumption.

Analysis of data

We calculated patients' mean age for the developmental events and consequences in the course of alcoholism as well as the mean time differences (time intervals) between successive anchors. The t-test (or median-test) was used to examine gender differences. Gender differences in the long-term treatment outcome were analysed with survival analyses according to Kaplan–Meier applying the corresponding log-rank test of elapsed time to relapse. In order to analyse interaction effects of gender and course of alcoholism (milestone variables, consequences of alcoholism) we additionally performed survival analyses with dichotomous variables after median split. We tested for differences between the resulting four groups (women with course variable > median, women with course variable < median, men with course variable > median, men with course variable < median). Using the same procedure we subsequently included the variables severity of alcohol dependence (SADQ score) and number of pre-treatments (detoxification and withdrawal treatment) in the Kaplan–Meier survival analyses, again testing for differences between the resulting four groups for each variable.

Results

Patient characteristics at baseline

Compared with the master sample (n = 454) that consisted entirely of white Europeans, the study sample (n = 212) showed a higher mean education level (mean = 2.71*, SD = 0.80 vs. mean = 2.53*, SD = 0.78; *1 = special school, 2 = general education secondary school, 3 = secondary modern school, 4 = grammar school) (χ^2 = 13.8, df = 3, p = .003). Age, marital status, rate of unemployed, average alcohol consumption and severity of alcohol dependence did not show significant differences between the master sample and the final study sample.

Gender comparison in the study sample (n = 212)

Demographic characteristics (Table 1): Since age and education were part of the matching procedure we found no gender differences. As expected employment showed significant gender differences since 21.7% of our enrolled women were housewives. The rate of registered unemployment (without housewives / househusbands) was comparatively low for a sample of alcoholics and revealed no significant gender differences like the remaining demographic data. The rate of subjects living in partnership was about two-thirds in both women and men, showing a comparatively good social integration of our study sample. Overall, alcohol consumption was comparatively high in our study sample. Although the average daily alcohol consumption during the previous year had been lower in women (women 153.02 ± 78.58 /day vs. men 182.80 ± 103.69 g/day, p = .020, Table 1), significant gender differences in average alcohol consumption no longer existed after controlling for differences in body mass. Mean duration of sobriety at baseline was nearly the same for females and males. Approximately two-thirds of enrolled women and three-quarters of matched males were smokers although this difference did not reach statistical significance. Furthermore, after controlling for differences in body mass smokers no longer displayed significant gender differences in average tobacco consumption.

Pre-treatment in the medical history: History of alcohol specific treatment in terms of number of pre-treatments did not show gender differences for either detoxification or withdrawal treatment. Baseline assessments (Table 1): The SADQ total score for severity of alcohol dependence showed severe dependence in our study sample without significant differences between the genders. Likewise the above-average premorbid verbal intelligence (MWT-B) failed to reveal significant differences between men and women. Overall, however, women demonstrated a significantly worse level of social functioning (GAF) and significantly more depressive symptoms (BDI) than men.

Onset and course of alcoholism

Significant gender differences were found for all milestone variables in the development and course of alcoholism preceding the first inpatient treatment (Table 2). Women started consuming alcohol later in their life, were older at their first intoxication, showed a later onset of continuous alcohol consumption, and alcohol dependence. In contrast, there was no significant gender difference for age at first inpatient treatment.

Table 1 Subject characteristics at baseline

Baseline variables		Women (n = 106)		Men (n = 106)		t/χ^2	Df	p
		M/N	SD/%	*M/N*	SD/%			
Sociodemographic data								
Age at baseline (years)	*M*, SD, *t*	41.65	8.42	41.90	8.58	0.21	210	.827
Education	*M*, SD, χ^2	2.71	0.80	2.71	0.80	0.00	3	1.000
Employment last year (weeks)	*M*, SD, *t*	30.60	23.14	38.97	21.25	2.74	210	.007
Registered unemployed	N, %, χ^2	24	22.6	23	21.7	0.02	1	.868
Living in partnership	N, %, χ^2	66	62.3	72	67.9	0.31	1	.578
Married, living together	*N*, %, χ^2	48	45.3	52	49.1	0.30	1	.582
Children	*N*, %, χ^2	63	59.4	73	68.9	2.05	1	.152
Addictive behaviour								
Alcohol consumption last year (g/day)	*M*, SD, *t*	153.02	78.58	182.80	103.69	2.33	205	.020
Alcohol consumption last year/weight (g/kg)	*M*, SD, *t*	2.54	1.33	2.40	1.41	0.74	203	.459
Abstinence prior to baseline (days)	*M*, SD, *t*	20.46	27.72	20.60	26.63	0.03	209	.970
Current smoker	*N*, %, χ^2	70	66	80	76	2.65	1	.104
Tobacco consumption (cig./day) in smokers	*M*, SD, *t*	24.87	11.49	29.87	16.69	2.16	141	.032
Tobacco consumption / weight (cig./kg)	*M*, SD, *t*	0.42	0.21	0,40	0.23	−0.60	143	.540
Pre-treatment in the medical history								
Number of inpatient alcohol detoxifications	*M*, SD, *t*	0.88	1.01	0.92	1.37	0.28	210	.776
Number of inpatient withdrawal treatments	*M*, SD, *t*	0.20	0.54	0.21	0.45	0.14	210	.890
Baseline assessments								
Severity of alcohol dependence (SADQ)	*M*, SD, *t*	44.94	15.04	44.13	16.74	−0.37	210	.710
Global Assessment of Functioning (GAF)	*M*, SD, *t*	63.24	10.85	66.23	10.55	1.99	202	.047
Premorbid, vocabulary intelligence (MWT-B)	*M*, SD, *t*	110.93	16.15	108.78	15.04	−0.99	205	.323
Beck Depression Inventory (BDI)	*M*, SD, *t*	14.00	9.23	11.41	8.45	−2.10	206	.036

Age and education are matching criteria
Education*: 1 = special school (“Sonderschule”, school for learning-disabled children),
2 = general education secondary school (“Hauptschule”)
3 = secondary modern school (“Realschule”)
4 = grammar school (“Gymnasium”)
*Please note that school systems differ between countries what limits translation
Employment: full time, part time, vocational education, unemployed: without housewives, pensioner, students
SADQ: Severity of Alcohol Dependence Questionnaire, range 0–60, results: > 30: “severe alcohol dependence”
GAF: Global Assessment of Functioning, range 0–100, results: 61–70: “mild symptoms or difficulty in social functioning, but generally functioning pretty well”
MWT-B “Mehrfachwahl Wortschatz Intelligentest” for premorbid, verbal intelligence, IQ value, mean Z = 100
BDI: Beck Depression Inventory, range 0–63, results: 10–18: “mild to moderate depression”
g: gram, kg: kilogram, cig.: cigarettes, consumption data (alcohol, tobacco) are given as daily average

Progression through the milestone variables (Table 2) demonstrated significant gender effects. Compared to men, women reported a significant shorter period between the beginning of continuous alcohol consumption and the onset of dependence as well as between onset of dependence and first inpatient treatment. Among women duration of alcohol dependence (6.25 ± 5.88 years) was significantly shorter compared to men (10.14 ± 7.03 years, p = .000, Table 2) despite the same mean age at baseline.

Consequences of alcoholism

Development of somatic, mental, and social consequences of alcoholism during the period between onset of continuous alcohol consumption and onset of adverse consequences differed significantly between the genders with this course evolving at a faster pace in women than men (Table 2). At baseline the interval since the onset of somatic and social adverse consequences also differed significantly between the genders with these durations of consequences being shorter in women than in men. Duration of mental consequences tended to differ in much the same way between the genders, although differences were smaller and did not reach statistical significance. Women had been experiencing somatic and social consequences only half as long as male patients (Table 2), while demonstrating a significantly worse level of social functioning (GAF) and significantly more depressive symptoms (BDI) than men (Table 1).

Treatment outcome

Inpatient treatment: All subjects (n = 212) completed the inpatient treatment program without alcohol relapse. Comparing long-term treatment outcome, women did not differ significantly from men. Kaplan-Maier curves, showing the time span between start of the outpatient aftercare and first consumption of alcohol, revealed no differences in survival between women (mean = 283.29 days, SD = 11.26 days) and

Table 2 Developmental events and consequences in the course of alcoholism

Variables in the development and course of alcoholism	Women (n = 106)		Men (n = 106)		t	df	p
	M	SD	M	SD			
Milestone variables, onset and time intervals							
First alcohol consumption (age)	15.85	4.45	14.50	3.98	−2.34	210	.020
Duration since onset of consumption (years)	25.79	4.66	27.41	4.14	1.72	210	.088
First alcohol intoxication (age)	21.72	8.45	17.05	3.95	−5.13	206	.000
Duration since first intoxication (years)	20.74	10.56	24.85	8.91	3.06	210	.002
Onset of continuous consumption (age)	25.30	7.85	20.08	4.66	−5.87	210	.000
Duration of continuous consumption (years)	16.35	8.89	21.82	9.03	4.44	210	.000
Onset of alcohol dependence (age)	35.40	8.63	31.66	8.46	−3.16	208	.001
Duration of alcohol dependence (years)	6.25	5.88	10.14	7.03	4.34	208	.000
Duration between onset of continuous consumption and onset of alcohol dependence (years)	10.01	4.12	11.60	4.19	1.98	208	.047
First inpatient treatment (age)	39.92	8.63	39.57	9.35	−0.28	210	.777
Duration between onset of alcohol dependence and first inpatient treatment (years)	4.52	4.83	7.91	6.86	3.96	208	.000
Consequences of alcoholism, onset and time intervals							
Onset of somatic adverse consequences (age)	37.03	8.92	35.19	8.52	−1.35	162	.178
Duration between onset of continuous consumption and onset of somatic adverse consequences (years)	12.35	8.50	15.56	8.33	2.44	162	.015
Duration since onset of somatic adverse events (years)	3.52	4.31	6.15	5.49	3.40	162	.001
Onset of mental adverse consequences (age)	35.65	9.72	33.92	9.16	−1.09	142	.276
Duration between onset of continuous consumption and onset of mental adverse consequences (years)	10.81	9.16	14.70	9.24	2.52	142	.012
Duration since onset of mental adverse events (years)	5.24	5.53	6.87	6.16	1.68	142	.096
Onset of social adverse consequences (age)	36.11	8.66	32.40	9.13	−2.29	124	.023
Duration between onset of continuous consumption and onset of social adverse consequences (years)	11.51	8.33	12.41	8.70	3.19	124	.001
Duration since onset of social adverse events (years)	4.75	5.29	8.65	7.60	3.19	124	.001

milestone variables and consequences in the development and course of alcoholism
duration: time period between onset and baseline if not otherwise specified
p = p value from *t*-tests

men (mean = 284.72 days, SD = 12.16 days, Fig. 1). The two-sided log rank was not significant (χ^2 = 0.02, df = 1, p = .872). Our evaluation of abstinence rates at the 12 months follow-up, at the end of the outpatient aftercare period, showed almost identical abstinence rates. Out of the total study sample (106 women and 106 men) 53 women (49.99%) compared to 54 men (50.94%) had remained abstinent (χ^2 = 0.07, df = 1, p = .784). The over-all rate of follow-up drop-outs was 33% in both men and women, with the majority of relapses and drop-outs occurring in the first 6 months of outpatient aftercare.

In order to determine whether gender-related differences in the course of alcoholism affect treatment outcome we included milestone variables, consequences of alcoholism (onset and time intervals, Table 2), severity of alcohol dependence (SADQ), and pre-treatment (number of detoxifications and withdrawal treatments, Table 1) after dichotomisation into the survival analyses. Solely the variables duration of alcohol dependence and duration of somatic consequences showed a prognostic impact on long term treatment outcome. A longer, above average (>median) duration of alcohol dependence significantly predicted abstinence in the survival analyses irrespective of gender (χ^2 = 5.13, df = 3, p = .024, Fig. 2). A longer, above average duration of somatic consequences showed a trend in the same direction (χ^2 = 7.15, df = 3, p = .057). The remaining variables in the course of alcoholism (onset and time intervals), severity of alcohol dependence, and pre-treatment did not have an impact on long-term treatment outcome.

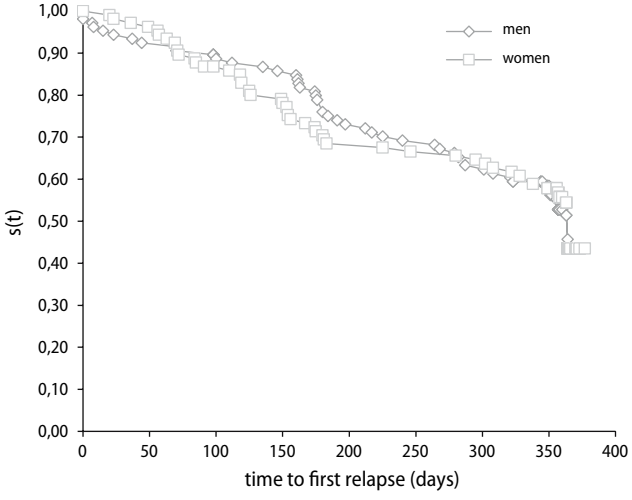

Fig. 1 Survival curves of long-term treatment outcome in women and men. Kaplan–Meier survival curves showing number of days to first relapse in the follow-up period. s(*t*) = survival as a function of time, p values

Discussion

Our prospective study on treatment outcome in alcoholism shows a favourable outcome in both wo-

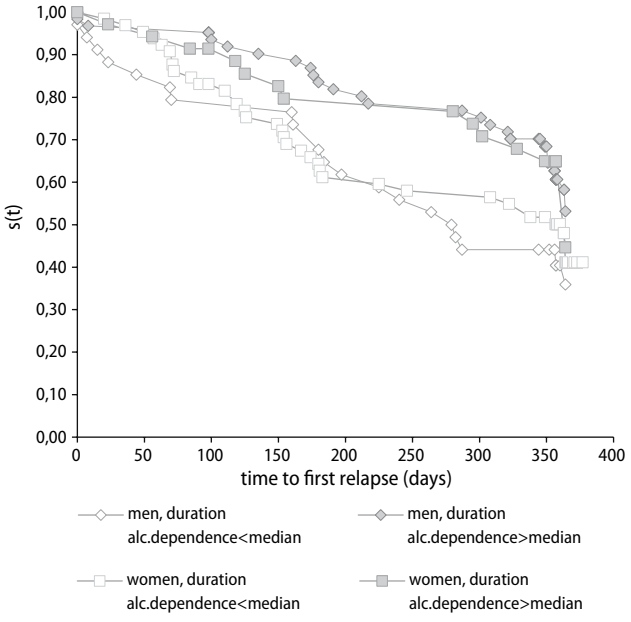

Fig. 2 Prognostic impact of the variable *duration of alcohol dependence* on long-term treatment outcome in women and men. Kaplan–Meier survival curves showing number of days to first relapse in the follow-up period. Duration of alcohol dependence as a dichotomous variable in the course of alcoholism after median split. s(*t*) = survival as a function of time, p values

men and men despite a telescoping effect with acceleration in the course of alcoholism in women. At the 12 months follow-up approximately 50% of women and men were still abstinent. In contrast previous studies on treatment outcome in alcoholism which demonstrated either a slightly more favourable outcome in women (Project Match) or a slightly less favourable outcome in women compared to men (Combine Study) our study sample consisted of heavy drinkers admitted for inpatient treatment. Overall, our data show significant gender differences concerning onset, course and consequences of alcoholism, with women showing a significantly faster progression in the development of alcoholism than men. While women start to consume alcohol, experience intoxication and become dependent on alcohol at a later age than men, their developmental course of alcoholism in terms of periods between onset of continuous alcohol consumption, onset of dependence and first inpatient treatment is significantly shorter compared to that seen in men. Thus, our data confirm the telescoping effect observed in previous studies (Hesselbrock 1991; Piazza et al. 1989; Randall et al. 1999). Additionally, we were able to show significant gender differences in the period between onset of continuous alcohol consumption and the onset of social and somatic adverse consequences. Our data demonstrate these differences more distinctly than previous studies, which had reported a rather similar development of alcohol related problems in women and men (Schuckit et al. 1995).

Assuming a gradual development the faster progression of milestone events and the earlier onset of adverse consequences suggest a higher vulnerability to alcohol in women. However, our data also indicate that in general this faster progression in women is not associated with a less favourable treatment outcome when compared to men. Quite contrary to our expectation, gender as an independent variable did not affect treatment outcome in the survival analysis. In the course of alcoholism the variable duration of alcohol dependence showed a significant difference between the genders with men experiencing a longer duration of alcohol dependence. Regarding the variable's prognostic impact on treatment outcome longer durations of alcohol dependence significantly predict abstinence following treatment in both women and men. Similarly, longer durations of somatic consequences of alcoholism also tend to predict abstinence.

Severity and duration of the course of alcoholism appear counterintuitive as a predictor of positive treatment outcome, since several earlier studies had revealed opposite findings. On the other hand not all studies were able to confirm this correlation (McKay and Weiss 2001). Especially a large study performed in Germany (Feuerlein and Kufner 1989) found a correlation between severity and positive outcome, which the authors commented on as raising more health concerns and thus providing better motivation. In a study on predictors of drinking outcome, showing somatic problems as a predictor of positive outcome (Staines et al. 2003), the authors' explanation for this phenomenon are enhanced rational problem assessment, problem solving regarding one's health, and the ongoing involvement in the health care system. Although we are not able to conclusively explain our finding of a favourable outcome after longer durations of alcohol dependence and somatic consequences we propose a motivational process affecting treatment outcome, with the motivation for abstinence and treatment likely increasing with duration and degree of the disease and its consequences.

Several potential limitations of our study need to be commented on. First, our results may be influenced by patient selection procedures, as our sample consisted of a subgroup of heavy drinkers with relatively good overall social adjustment. Furthermore, the comparison of vulnerability to alcohol requires equivalent alcohol consumption resulting in the same blood alcohol concentrations. In our study we controlled alcohol consumption for body mass only. However, gender differences in alcohol consumption do not reach significance even after controlling for supposed differences in body water with 50% of total body weight in women and 60% of total body weight in men. Finally, we are well aware that the present study does not take all variables into account that might be important for predicting outcome since our explicit focus is on the development and course of alcoholism.

Conclusion

In closing, our data offer information on the gender related time course in the development of alcoholism and the appearance of consequences of alcoholism, information on long term treatment outcome for a well matched clinical sample of heavy drinking alcohol dependent women and men, as well as information on the impact of the course of alcoholism on treatment outcome. Based on our results we do not see a differential gender specific treatment outcome in alcohol dependent women and men, although outcome seems to be affected by the course of alcoholism which shows typical gender differences with telescoping in women. Although the counterintuitive effect of a more favourable outcome noted after longer durations of alcohol dependence and somatic consequences remains to be explained and needs confirmation, our findings question the hypothesis of an increasingly unfavourable treatment outcome in association with longer durations of the disease in several subgroups of alcohol dependent patients.

References

Acker C (1986) Neuropsychological deficits in alcoholics: the relative contributions of gender and drinking history. Br J Addict 81:395–403

Ammon E, Schafer C, Hofmann U, Klotz U (1996) Disposition and first-pass metabolism of ethanol in humans: is it gastric or hepatic and does it depend on gender? Clin Pharmacol Ther 59:503–513

Anton RF, O'Malley SS, Ciraulo DA, Cisler RA, Couper D, Donovan DM, Gastfriend DR, Hosking JD, Johnson BA, LoCastro JS, Longabaugh R, Mason BJ, Mattson ME, Miller WR, Pettinati HM, Randall CL, Swift R, Weiss RD, Williams LD, Zweben A (2006) Combined pharmacotherapies and behavioral interventions for alcohol dependence: the COMBINE study: a randomized controlled trial. JAMA 295:2003–2017

Ashley MJ, Olin JS, le Riche WH, Kornaczewski A, Schmidt W, Rankin JG (1977) Morbidity in alcoholics. Evidence for accelerated development of physical disease in women Arch Intern Med 137:883–887

Ballesteros J, Gonzalez-Pinto A, Querejeta I, Arino J (2004) Brief interventions for hazardous drinkers delivered in primary care are equally effective in men and women. Addiction 99:103–108

Beck AT, Beamesderfer A (1974) Assessment of depression: the depression inventory. Mod Probl Pharmacopsychiatry 7:151–169

Bottlender M, Soyka M (2005) Outpatient alcoholism treatment: predictors of outcome after 3 years. Drug Alcohol Depend 80:83–89

Bucholz KK, Homan SM, Helzer JE (1992) When do alcoholics first discuss drinking problems? J Stud Alcohol 53:582–589

Chou SP, Dawson DA (1994) A study of the gender differences in morbidity among individuals diagnosed with alcohol abuse and/or dependence. J Subst Abuse 6:381–392

DSM-IV (1996) Diagnostic and Statistical Manual of Mental Disorder, Fourth Edition (DSM-IV). American Psychiatric Association, Washington, DC

Fernandez-Sola J, Estruch R, Nicolas JM, Pare JC, Sacanella E, Antunez E, Urbano-Marquez A (1997) Comparison of alcoholic cardiomyopathy in women versus men. Am J Cardiol 80:481–485

Feuerlein W, Kufner H (1989) A prospective multicentre study of in-patient treatment for alcoholics: 18- and 48-month follow-up (Munich Evaluation for Alcoholism Treatment, MEAT). Eur Arch Psychiatry Neurol Sci 239:144–157

Foster JH, Peters TJ, Marshall EJ (2000) Quality of life measures and outcome in alcohol-dependent men and women. Alcohol 22:45–52

Frezza M, di Padova C, Pozzato G, Terpin M, Baraona E, Lieber CS (1990) High blood alcohol levels in women. The role of decreased gastric alcohol dehydrogenase activity and first-pass metabolism N Engl J Med 322:95–99

Gomberg ES (1993) Women and alcohol: use and abuse. J Nerv Ment Dis 181:211–219

Hanna E, Dufour MC, Elliott S, Stinson F, Harford TC (1992) Dying to be equal: women, alcohol, and cardiovascular disease. Br J Addict 87:1593–1597

Hesselbrock MN (1991) Gender comparison of antisocial personality disorder and depression in alcoholism. J Subst Abuse 3:205–219

Hesselbrock MN, Meyer RE, Keener JJ (1985) Psychopathology in hospitalized alcoholics. Arch Gen Psychiatry 42:1050–1055

Hommer D, Momenan R, Kaiser E, Rawlings R (2001) Evidence for a gender-related effect of alcoholism on brain volumes. Am J Psychiatry 158:198–204

Hommer D, Momenan R, Rawlings R, Ragan P, Williams W, Rio D, Eckardt M (1996) Decreased corpus callosum size among alcoholic women. Arch Neurol 53:359–363

Jarvis TJ (1992) Implications of gender for alcohol treatment research: a quantitative and qualitative review. Br J Addict 87:1249–1261

Johnson PB, Richter L, Kleber HD, McLellan AT, Carise D (2005) Telescoping of drinking-related behaviors: gender, racial/ethnic, and age comparisons. Subst Use Misuse 40:1139–1151

Jones BM, Jones MK (1976) Alcohol effects in women during the menstrual cycle. Ann N Y Acad Sci 273:576–587

Lehrl S, Triebig G, Fischer B (1995) Multiple choice vocabulary test MWT as a valid and short test to estimate premorbid intelligence. Acta Neurol Scand 91:335–345

Loft S, Olesen KL, Dossing M (1987) Increased susceptibility to liver disease in relation to alcohol consumption in women. Scand J Gastroenterol 22:1251–1256

Mann K, Ackermann K, Croissant B, Mundle G, Nakovics H, Diehl A (2005) Neuroimaging of gender differences in alcohol dependence: are women more vulnerable? Alcohol Clin Exp Res 29:896–901

Mann K, Batra A (1993) [Community based management of alcohol dependent patients. Evaluation of a combined inpatient and ambulatory treatment concept] Psychiatr Prax 20:102–105

Mann K, Batra A, Gunthner A, Schroth G (1992) Do women develop alcoholic brain damage more readily than men? Alcohol Clin Exp Res 16:1052–1056

Mann K, Kapp B, Kühnel P, Federle E (1995) Good estimates for reliability and validity in alcoholics' self reports. Alcohol and Alcoholism 30:545–545

McKay JR, Weiss RV (2001) A review of temporal effects and outcome predictors in substance abuse treatment studies with long-term follow-ups. Preliminary results and methodological issues Eval Rev 25:113–161

O'Connor PG, Horwitz RI, Gottlieb LD, Kraus ML, Segal SR (1993) The impact of gender on clinical characteristics and outcome in alcohol withdrawal. J Subst Abuse Treat 10:59–61

Olenick NL, Chalmers DK (1991) Gender-specific drinking styles in alcoholics and nonalcoholics. J Stud Alcohol 52:325–330

Pequignot G, Chabert C, Eydoux H, Courcol MA (1974) Augmentation du risque de cirrhose en fonction de la ration d'alcool. Rev l' Alcoolisme 20:191–202

Pfefferbaum A, Rosenbloom M, Deshmukh A, Sullivan E (2001) Sex differences in the effects of alcohol on brain structure. Am J Psychiatry 158:188–197

Piazza NJ, Vrbka JL, Yeager RD (1989) Telescoping of alcoholism in women alcoholics. Int J Addict 24:19–28

Project MATCH Research Group (1997) Matching Alcoholism Treatments to Client Heterogeneity: Project MATCH post-treatment drinking outcomes. J Stud Alcohol 58:7–29

Project MATCH Research Group (1998) Matching alcoholism treatments to client heterogeneity: Project MATCH three-year drinking outcomes. Alcohol Clin Exp Res 22:1300–1311

Rabinovitz M, Van Thiel DH, Dindzans V, Gavaler JS (1989) Endoscopic findings in alcoholic liver disease: does gender make a difference? Alcohol 6:465–468

Randall CL, Roberts JS, Del Boca FK, Carroll KM, Connors GJ, Mattson ME (1999) Telescoping of landmark events associated with drinking: a gender comparison. J Stud Alcohol 60:252–260

Ross HE (1989) Alcohol and drug abuse in treated alcoholics: a comparison of men and women. Alcohol Clin Exp Res 13:810–816

Ross HE, Glaser FB, Germanson T (1988) The prevalence of psychiatric disorders in patients with alcohol and other drug problems. Arch Gen Psychiatry 45:1023–1031

Sanchez-Craig M, Spivak K, Davila R (1991) Superior outcome of females over males after brief treatment for the reduction of heavy drinking: replication and report of therapist effects. Br J Addict 86:867–876

Schuckit MA, Anthenelli RM, Bucholz KK, Hesselbrock VM, Tipp J (1995) The time course of development of alcohol-related problems in men and women. J Stud Alcohol 56:218–225

Schuckit MA, Daeppen JB, Tipp JE, Hesselbrock M, Bucholz KK (1998) The clinical course of alcohol-related problems in alcohol dependent and nonalcohol dependent drinking women and men. J Stud Alcohol 59:581–590

Seppa K, Sillanaukee P (1994) Women, alcohol, and red cells. Alcohol Clin Exp Res 18:1168–1171

Staines G, Magura S, Rosenblum A, Fong C, Kosanke N, Foote J, Deluca A (2003) Predictors of drinking outcomes among alcoholics. Am J Drug Alcohol Abuse 29:203–218

Stockwell T, Hodgson R, Edwards G, Taylor C, Rankin H (1979) The development of a questionnaire to measure severity of alcohol dependence. Br J Addict Alcohol Other Drugs 74:79–87

Timko C, Moos RH, Finney JW, Connell EG (2002) Gender differences in help-utilization and the 8-year course of alcohol abuse. Addiction 97:877–889

Urbano-Marquez A, Estruch R, Fernandez-Sola J, Nicolas JM, Pare JC, Rubin E (1995) The greater risk of alcoholic cardiomyopathy and myopathy in women compared with men. JAMA 274:149–154

York JL, Welte JW (1994) Gender comparisons of alcohol consumption in alcoholic and nonalcoholic populations. J Stud Alcohol 55:743–750