

High Serum Cholesterol and Risk of Suicide

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Objective: The study was conducted to estimate the association between serum total cholesterol concentration and mortality from suicide. **Method:** The baseline serum total cholesterol concentration of 37,635 adults was determined in five independent population surveys conducted during 1972–1992 in Finland. Mortality from different causes of death was monitored for a mean of 14.6 years after the survey dates. The means for violent suicides (N=130) included hanging, firearms, cutting, jumping, and unspecified means. The means for nonviolent suicides (N=46) included drug overdose, poisoning with gases, and drowning. **Results:** Serum total cholesterol concentration was positively related to the risk of violent suicide. Among subjects whose serum total cholesterol concentration was in the highest category, the adjusted relative risk was more than twofold compared with the lowest category. The violent/nonviolent suicide ratio increased linearly with increasing cholesterol category. No association between serum total cholesterol concentration and the risk of nonviolent suicide was found. **Conclusions:** This is the first study to demonstrate the positive relationship of high serum total cholesterol concentration with increased risk of violent suicide.

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The association between low serum total cholesterol concentration and mortality from violent causes was extensively debated during the 1990s (1). However, in most of the observational studies, including our earlier report (2), the combined mortality from accidents, suicides, and homicides was the main outcome measure. We suggest that this combined mortality measure is an artificial grouping of deaths that do not share a common etiology. Only a few follow-up studies with an adequate number of suicides have analyzed the association between serum total cholesterol concentration and the risk of suicide. Some of these studies reported an inverse association (3–5), one study found a positive relationship (6), and another was inconclusive (7).

One possible explanation for these controversial findings may be that the previous studies considered all suicides as a homogenous group of deaths. However, the degree of violence and lethality varies between different methods of suicide (8). Hanging and firearms are considered the most lethal methods; they are more likely to

be immediately fatal, are associated with a high level of impulsivity, are absolutely or relatively equal in their degree of accessibility, and are difficult to reverse. Drug overdose, poisoning with gases, and drowning are less immediately fatal, leave time for someone to intervene, and vary in degree of accessibility (9).

The purpose of the study reported here was to evaluate the association between serum total cholesterol concentration and the risk of violent and nonviolent suicide at the population level.

METHOD

Five independent population surveys during 1972–1992 have assessed the levels of risk factors for coronary heart disease in Finland. For each survey, an independent random sample (age range=25–64 years) was drawn from the National Population Register. Details of the survey procedures have been described in earlier reports (2, 10). Informed written consent was obtained from the participants. In this study serum total cholesterol concentration was categorized into four levels: <5.00 mmol/liter (193.3 mg/dl), 5.00–6.49 mmol/liter (193.3–251.0 mg/dl), 6.50–7.99 mmol/liter (251.1–309.3 mg/dl), and ≥8.00 mmol/liter (309.4 mg/dl).

The subjects (N=37,635) were followed until Dec. 31, 1995. The mean follow-up was 14.6 years (range=1–24). Information on deaths was obtained from the National Mortality Register. The violent suicide methods included suicides by hanging, strangulation, or suffocation (ICD-E953), firearms or explosives (ICD-E955), cutting or piercing instruments (ICD-E956), jumping from a high place (ICD-E957), and other or unspecified means (ICD-E959). Drug overdose (ICD-E950), poisoning with gases or vapors (ICD-E951,

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TABLE 1. Adjusted Relative Risk^a and Ratio of Violent and Nonviolent Suicides, by Serum Total Cholesterol Concentration in Five Independent Random Samples of the Population of Finland, 1972–1992

Serum Cholesterol (mmol/liter)	Violent Suicides			Nonviolent Suicides			% With Violent Methods ^b	Violent/Nonviolent Suicide Ratio
	N	Adjusted Relative Risk	95% CI	N	Adjusted Relative Risk	95% CI		
<5.00 (N=6,058)	9	1.00		9	1.00		50.0	1.00
5.00–6.49 (N=16,326)	53	1.56	0.76–3.19	18	0.70	0.31–1.62	74.6	2.94
6.50–7.99 (N=11,302)	41	1.39	0.65–2.95	13	0.71	0.28–1.80	75.9	3.15
≥8.00 (N=3,949)	27	2.39 ^c	1.07–5.31	6	0.96	0.30–3.03	81.8	4.50

^a Adjusted for several confounding demographic and clinical factors.

^b Mantel-Haenszel test for linear trend ($\chi^2=4.04$, $df=1$, $p=0.04$).

^c Significantly greater than for the lowest cholesterol category (Wald $\chi^2=4.57$, $df=1$, $p=0.03$).

ICD-E952), and drowning or submersion (ICD-E954) were classified as nonviolent methods of suicide.

Adjusted relative risks of suicide were computed from the coefficients estimated by the Cox proportional hazards regression model with the SAS statistical software controlling for sex, age, marital status, education, smoking, alcohol consumption, coffee drinking, physical activity, body mass index, minor psychiatric symptoms, psychotropic medication, coronary heart disease, and subjective general health. The relationship between serum total cholesterol concentration and violent/nonviolent suicide ratio was estimated by the Mantel-Haenszel chi-square test for linear association.

RESULTS

Among 18,344 men there were 114 violent and 30 nonviolent suicides. Among 19,291 women, 16 suicides were committed by violent methods and another 16 by nonviolent methods. The most common methods altogether were hanging (N=78), firearms (N=42), and drug overdose (N=30).

Serum total cholesterol concentration was positively related to the risk of violent suicide (table 1). In the highest serum total cholesterol concentration category, the adjusted relative risk of violent suicide was more than twofold compared with the lowest category. When used as a continuous variable in the Cox model, serum total cholesterol concentration (mmol/liter) was also associated with the risk of violent suicide (relative risk=1.16, 95% confidence interval [CI]=1.01–1.32, $p=0.03$). No association between serum total cholesterol concentration and the risk of nonviolent suicide was found. The violent/nonviolent suicide ratio increased linearly from the lowest to the highest serum total cholesterol concentration category.

We had also data on serum high-density lipoprotein cholesterol from 17,753 subjects. During the follow-up period, 33 violent and 21 nonviolent suicides were committed in this subgroup. The relative risk of violent suicide was 0.58 (95% CI=0.25–1.30, n.s.) in the middle tertile, and 0.32 (95% CI=0.10–1.02, $p=0.054$) in the highest tertile, compared to the lowest serum high-density lipoprotein cholesterol tertile. No trend was found in regard to the risk of nonviolent suicide. The violent/nonviolent suicide ratio decreased linearly (3.33, 1.13, 0.57) from the lowest to the highest serum high-density lipoprotein cholesterol tertile (Mantel-Haenszel $\chi^2=5.87$, $df=1$, $p=0.02$).

DISCUSSION

Serum total cholesterol concentration was related to the risk of violent suicide both as a categorical variable and as a continuous variable in the Cox model. However, only the relative risk of the highest serum total cholesterol concentration category was significantly higher compared with the lowest category. We do not think that a threshold effect would have been responsible for this finding. Instead we suggest that the number of violent suicides in this study was too small to demonstrate the linear relationship across the categories. The significant results found when using serum total cholesterol concentration as a continuous variable also support this view.

We found that violent/nonviolent suicide ratio increased linearly with increasing serum total cholesterol concentration level, and decreased linearly with increasing serum high-density lipoprotein cholesterol level. These results clearly support each other. There seems to be an inverse relationship between plasma polyunsaturated fatty acids and the ratio of serum total cholesterol concentration/serum high-density lipoprotein cholesterol (11). Thus subjects with high serum total cholesterol concentration or low serum high-density lipoprotein cholesterol have low levels of polyunsaturated fatty acids, and depletion of omega-3 polyunsaturated fatty acids has recently been linked to depression (12). It has been suggested that increasing rates of depression—one of the strongest risk factors for suicide—during this century in the Western world could be influenced by increased dietary consumption of saturated fatty acids and decreased intake of polyunsaturated fatty acids, with cholesterol being just a surrogate marker of these changes (13).

Future research should examine dietary aspects in the prevention and treatment of violent, autoaggressive behaviors leading to suicide.

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