

Original Research Paper

LDL Cholesterol, Hypertension, and Stroke Subtype among Hospitalized Patients in Palangka Raya

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Abstract

Background: Low density lipoprotein cholesterol and hypertension are established vascular risk factors, but their associations with stroke subtype require careful evaluation in hospital based populations. **Objectives:** To examine associations of LDL cholesterol and hypertension with ischemic versus other stroke diagnoses among hospitalized stroke patients. **Methods:** This observational cross sectional study analyzed retrospective records from RSUD dr. Doris Sylvanus, Palangka Raya, from January to December 2024. Purposive sampling included 142 of 352 records, comprising 107 ischemic and 35 other stroke diagnoses. Unadjusted odds ratios (ORs), 95% confidence intervals (CIs), and two sided tests were calculated from aggregate counts. **Results:** High LDL was associated with ischemic stroke classification (OR 2.90; 95% CI 1.26–6.67; $p=0.010$). Reconstruction from the internally consistent joint exposure table yielded an OR of 2.74 for hypertension (95% CI 1.17–6.38; $p=0.017$). Compared with normal LDL without hypertension, high LDL with hypertension had OR 4.00 (95% CI 1.57–10.22; Fisher $p=0.004$). Hypertension counts require confirmation because source tables were inconsistent. **Conclusions:** High LDL was associated with greater odds of ischemic rather than other stroke diagnoses. These analyses do not establish incidence, causality, independent effects, or interaction.

Keywords: Cross sectional study; Hypertension; Ischemic stroke; LDL cholesterol; Medical records.

Introduction

Stroke remains a major source of disability and mortality. The Global Burden of Disease analysis for 2021 identified ischemic stroke as the most frequent incident stroke subtype worldwide¹. The World Stroke Organization fact sheet provides complementary estimates of this continuing burden². In Indonesia, the 2023 national health survey includes stroke indicators relevant to service planning³. The present hospital recorded 352 stroke records in 2024. This hospital count is a sampling frame, rather than a population prevalence estimate.

Ischemic stroke comprises heterogeneous vascular mechanisms, including large artery disease, cardioembolism, and small vessel injury⁴. Atherosclerosis involves lipid retention and inflammatory responses within the arterial wall⁵, and genetic, epidemiological, and clinical evidence supports the causal contribution of LDL to atherosclerotic cardiovascular disease⁶. Hypertension affects cerebral vascular structure and autoregulation⁷ and remains an important global health concern⁸. These mechanisms provide a rationale for examining routinely recorded

LDL and hypertension categories in hospitalized stroke populations.

INTERSTROKE identified multiple modifiable factors associated with stroke across international settings⁹. A Chinese population survey specifically evaluated the joint association of hyperlipidemia and hypertension with ischemic stroke, including formal interaction analyses¹⁰. Prevention guidance emphasizes integrated vascular assessment¹¹. Those population studies and recommendations provide context; a comparison restricted to hospitalized stroke patients addresses a different question: the distribution of ischemic versus other stroke diagnoses within that selected group.

Indonesian evidence also illustrates the diversity of relevant outcomes. Handayani and colleagues examined vascular comorbidities and neurological outcomes among ischemic stroke patients with hypersomnia¹². Minarti and colleagues investigated BDNF in relation to depression after ischemic stroke¹³, while an HTJ case report addressed pharmaceutical care in a patient with ischemic stroke, diabetes, and hypertension¹⁴. These studies concern outcomes or care after stroke and do not supply an estimate of stroke incidence for the present hospital.

The local evidence gap concerns the relationship of routinely recorded LDL and hypertension categories with stroke subtype at RSUD dr. Doris Sylvanus. This study aimed to describe the hospitalized sample and estimate unadjusted odds of an ischemic rather than another stroke diagnosis by LDL category, hypertension category, and their joint categories. Its contribution is a transparent local comparison with explicit reference groups. HTJ research on cardiometabolic surveillance¹⁵, clinical hypertension characteristics¹⁶, and age in relation to cerebral small vessel disease on MRI¹⁷ further supports examination of vascular

profiles while keeping distinct study populations and outcomes separate.

Materials and Methods

Study Design

This analytical observational study used a cross sectional design based on retrospective medical records of stroke hospitalizations at RSUD dr. Doris Sylvanus, Palangka Raya, from January to December 2024. The outcome was recorded stroke subtype: ischemic diagnosis versus the remaining recorded stroke diagnoses, termed other stroke in this report. The comparator consists of patients with stroke, not people without stroke. Accordingly, the analysis estimates subtype odds within a hospitalized sample. STROBE¹⁸ and RECORD¹⁹ guide transparent reporting of selection and routinely collected data.

Sample

The source manuscript reports a frame of 352 stroke records and 142 records selected through purposive nonprobability sampling. The analyzed records comprise 107 ischemic and 35 other stroke diagnoses. The selected fraction is 40.3%; 210 records (59.7%) were not analyzed. The available account does not provide a breakdown of these 210 records by exclusion criterion, missing laboratory data, unavailable blood pressure information, or duplicate admissions. It also does not establish whether only the first admission per patient was retained. A reason specific selection log is required to complete the participant flow.

Purposive sampling was the reported approach to selecting records meeting study criteria; it does not provide known selection probabilities. The supplied account does not state the individual inclusion and exclusion criteria or a prospective sample size calculation. Therefore, 142 is described as the analyzed sample size, without attributing an undocumented power calculation or

representativeness to it. The eligibility checklist, selection rationale, and handling of repeat admissions must be confirmed from the original extraction protocol.

Data Collection Technique

The variables available in the aggregate dataset were sex, age category, recorded LDL category, recorded hypertension category, and stroke subtype. The analysis retains the source LDL labels high and normal and hypertension labels yes and no. A numeric LDL threshold, measurement unit, blood sampling time relative to admission, fasting status, and preceding lipid treatment are not documented in the supplied methods. No conventional cutoff is substituted for the actual study definition. Similarly, the original record form must establish whether hypertension represented a prior diagnosis, treatment history, or measured blood pressure and which diagnostic threshold was used.

Stroke classification follows the recorded diagnosis. The supplied methods do not identify the imaging criterion, diagnostic coding system, or the constituent diagnoses in the other stroke group; therefore, all comparators are not assumed to have a verified hemorrhagic stroke diagnosis. The extraction protocol should specify the clinical and imaging basis for each category, consistent with contemporary stroke definitions²⁰. No participant identifiers or individual records were provided for this revision. Aggregate counts alone cannot establish source record completeness or undocumented imputation.

Data Analysis Technique

Sex and age use column percentages with denominators 107, 35, and 142. Exposure comparisons use row percentages. For each 2×2 comparison, the unadjusted OR is ad/bc , where a and b are ischemic and other stroke counts in the exposed category and c and d are those counts in the reference category. Approximate 95% CIs are $\exp[\ln(OR) \pm 1.96 \times$

$\sqrt{1/a + 1/b + 1/c + 1/d}]$. Two sided Pearson chi square tests without continuity correction use a significance threshold of 0.05 when all expected cells are at least five. Fisher exact tests supplement these results and are used for joint category comparisons with small cells. Numerical reporting follows SAMPL principles²¹.

The LDL counts are consistent across the source descriptive and joint tables. Hypertension counts differ: the source descriptive table gives 15 other stroke records without hypertension, the source bivariate table gives 19, and the joint table implies 13. The joint table totals 142 records and reproduces the recorded stroke and LDL totals. Hypertension and joint category estimates are therefore recalculated from that table as explicitly provisional aggregate reconstructions. This numerical consistency does not confirm the original patient classifications. Final verification requires the source record sheet.

Joint comparisons use normal LDL without hypertension as the reference. Each of the other three categories is compared separately with that reference using a two sided Fisher test. These are exploratory unadjusted comparisons, without multiplicity correction. No covariate adjusted logistic model or interaction test is reported because verified individual records and potential confounder data are unavailable. The results do not establish independent effects, synergy, or a temporal association.

Ethical Consideration

The source acknowledgment states that the hospital granted permission and supported record collection. The supplied manuscript does not report an ethics committee name, approval or waiver identifier, approval date, consent waiver decision, or documented confidentiality and deidentification procedures. These details must be supplied from the institutional authorization records before publication. Hospital permission is reported

separately from ethics review, and a retrospective design is not treated as an automatic waiver of review or consent.

Result

The analyzed sample comprised 142 records: 107 ischemic diagnoses (75.4%) and 35 other

stroke diagnoses (24.6%). Men accounted for 90 records (63.4%), and 72 patients (50.7%) were aged at least 60 years. Table 1 presents sex and age with consistent column denominators. These sample distributions do not estimate population stroke rates by age or sex.

Table 1. Recorded demographic characteristics by stroke subtype

Characteristic	Category	Ischemic, n (%)	Other stroke, n (%)	Total, n (%)
Sex	Men	67 (62.6)	23 (65.7)	90 (63.4)
	Women	40 (37.4)	12 (34.3)	52 (36.6)
Age	Below 50 years	20 (18.7)	6 (17.1)	26 (18.3)
	50 to 59 years	34 (31.8)	10 (28.6)	44 (31.0)
	At least 60 years	53 (49.5)	19 (54.3)	72 (50.7)
Total		107 (100.0)	35 (100.0)	142 (100.0)

Percentages are within columns: ischemic $n = 107$, other stroke $n = 35$, and total $N = 142$.

Table 2. Recorded LDL category and stroke subtype

LDL category	Ischemic, n (%)	Other stroke, n (%)	Total	OR (95% CI)	Pearson p
High	87 (80.6)	21 (19.4)	108	2.90 (1.26 to 6.67)	0.010
Normal	20 (58.8)	14 (41.2)	34	1.00	
Total	107	35	142		

Percentages are within rows. LDL = low density lipoprotein; OR = odds ratio; CI = confidence interval. Pearson test has $df = 1$; Fisher $p = 0.020848$. Reference: normal LDL.

Table 3. Hypertension and stroke subtype reconstructed from source joint counts

Hypertension	Ischemic, n (%)	Other stroke, n (%)	Total	OR (95% CI)	Pearson p
Yes	88 (80.0)	22 (20.0)	110	2.74 (1.17 to 6.38)	0.017
No	19 (59.4)	13 (40.6)	32	1.00	
Total	107	35	142		

Provisional reconstruction: $88 = 80 + 8$, $22 = 20 + 2$, $19 = 7 + 12$, and $13 = 1 + 12$ from Table 4. The value 13 is an aggregate reconstruction, Percentages are within rows. Hypertension yes and no retain the source labels. Pearson chi square = 5.678, $df = 1$, $p = 0.017183$; smallest expected cell = 7.89; Fisher $p = 0.033950$.

Table 4. Exploratory joint exposure comparisons using a common reference

LDL / hypertension	Ischemic, n (%)	Other stroke, n (%)	Total	OR (95% CI)	Fisher p
High / Yes	80 (80.0)	20 (20.0)	100	4.00 (1.57 to 10.22)	0.004
High / No	7 (87.5)	1 (12.5)	8	7.00 (0.74 to 65.95)	
Normal / Yes	8 (80.0)	2 (20.0)	10	4.00 (0.70 to 22.88)	0.141
Normal / No	12 (50.0)	12 (50.0)	24	1.00	
Total	107	35	142		

Percentages are within rows. Each OR compares the indicated category with normal LDL without hypertension; for both exposures, $OR = (80 \times 12)/(20 \times 12) = 4.00$. Fisher p values before rounding are 0.004330, 0.100582, and 0.141263, respectively.

High LDL was recorded in 108 of 142 records (76.1%), including 87 of 107 ischemic records (81.3%) and 21 of 35 other stroke records (60.0%). Normal LDL accounted for 34 records (23.9%). The joint table reconstruction yields 110 records with hypertension (77.5%) and 32 without hypertension (22.5%). Among ischemic records, 88 of 107 (82.2%) had hypertension. Hypertension totals and all analyses involving hypertension remain subject to verification of the conflicting source counts.

The proportion with an ischemic diagnosis was 80.6% in the high LDL category and 58.8% in the normal LDL category. The unadjusted OR was 2.90 (95% CI 1.26 to 6.67), with Pearson chi square = 6.576, df = 1, p = 0.010 (unrounded p = 0.010338). The smallest

expected cell was 8.38; Fisher p = 0.021. Table 2 reports these consistent LDL counts.

The reconstructed hypertension comparison gives OR 2.74 with a 95% CI of 1.17 to 6.38 and Pearson p = 0.017, replacing the incompatible previously reported OR, CI, and p value combination. The originally attributed joint OR of 2.737 is reproduced by pooling hypertension counts across LDL categories: $(88 \times 13)/(22 \times 19)$. It is therefore a marginal hypertension OR, rather than the OR for both exposures relative to neither exposure.

Figure 1 summarizes the proportion with an ischemic diagnosis within the recorded LDL categories. These percentages describe stroke subtype within the selected hospital sample and do not represent the probability of developing stroke.

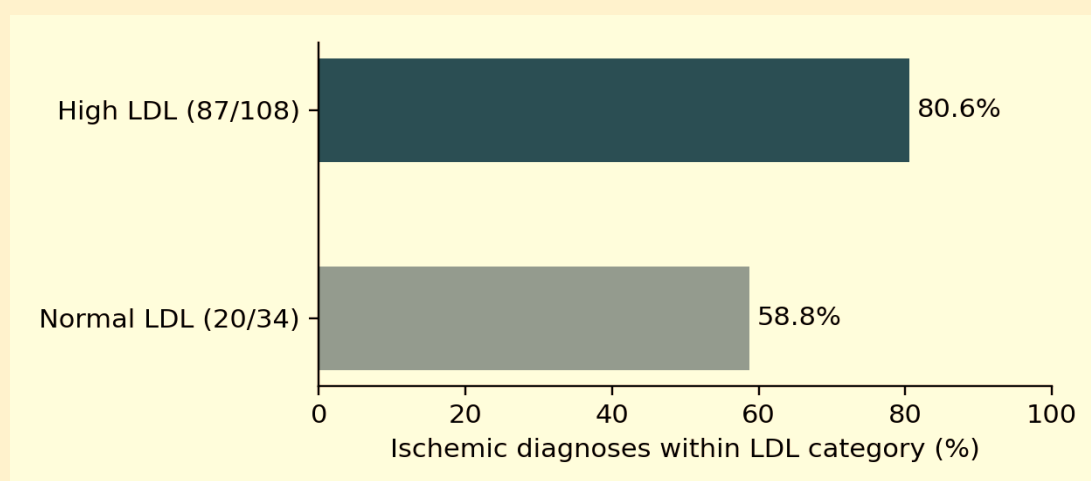


Figure 1. Ischemic stroke classification by LDL category. Numerators and denominators are shown in labels; data correspond to Table 2.

The reproducible LDL comparison supports an association with ischemic versus other stroke classification. Reconstructed hypertension and joint comparisons are numerically coherent with the source joint table but require confirmation against original records. Table 4 provides explicit reference categories rather than a single undefined pooled effect. Neither incident stroke risk nor

independent or interactive effects were estimated.

Discussion

Interpretation of Key Findings. High recorded LDL was associated with greater odds of an ischemic rather than another stroke diagnosis. LDL related atherosclerotic mechanisms described in the literature provide a plausible

context^{5,6}, but were not measured here. The hypertension comparison and joint categories are retained as transparent exploratory reconstructions pending source verification. The OR of 4.00 for both exposures describes one categorical comparison; it does not establish that the exposures interact.

Comparison with Previous Studies. The population survey by Wang and colleagues formally assessed interaction between hyperlipidemia and hypertension¹⁰. Its lipid definition, sampling frame, and adjusted analyses differ from this study, so its findings are not used to infer an interaction here. Handayani and colleagues examined neurological outcomes in ischemic stroke with hypersomnia¹², and Minarti and colleagues examined BDNF and depression after stroke¹³. These outcomes differ from stroke subtype. The HTJ case report emphasizes monitoring pharmaceutical care with coexisting vascular conditions¹⁴. Cardiometabolic surveillance¹⁵ and hypertension research in Palu¹⁶ similarly provide regional context rather than equivalent effect estimates.

Age and sex describe the selected admissions. International literature discusses sex specific patterns in stroke epidemiology and outcomes²², and the HTJ MRI study examined age in relation to cerebral small vessel disease¹⁷. These findings support broader clinical context but do not explain the observed predominance of men or older patients in this dataset. Smoking, alcohol intake, psychosocial stress, and diet were not measured. Potential lifestyle pathways discussed in INTERSTROKE⁹ remain external hypotheses rather than observed characteristics or mechanisms in these patients.

Clinical and Public Health Implications. The findings support attention to documented lipid and blood pressure profiles when describing local stroke admissions. Secondary prevention guidance addresses individualized

vascular management after stroke²³. Randomized evidence from SPARCL²⁴, Treat Stroke to Target²⁵, and PROGRESS²⁶ supports lipid and blood pressure management in defined clinical populations. These external trials supply evidence for treatment; the present study does not test treatment efficacy or establish a study specific therapeutic threshold.

Advantages and Limitations. This hospital dataset combines stroke subtype, LDL category, and hypertension in an explicit comparison framework. Its scope is a single center with purposive sampling and retrospective records. Selection among 352 records, uncertain handling of repeat admissions and missing measurements, and incomplete operational definitions may affect classification and generalizability. Residual confounding by age, sex, diabetes, treatment, and other vascular factors remains because no multivariable adjustment was performed. Inconsistent hypertension counts require source reconciliation. Sparse joint categories yield wide confidence intervals. These constraints define the evidence as an unadjusted hospital subtype comparison and preclude causal, population risk, and synergy claims.

Recommendations for Future Research. A verified extraction register should document eligibility, exclusion reasons, duplicate handling, diagnostic criteria, LDL timing and thresholds, and hypertension definitions. Future analyses should use confirmed individual records and prespecified covariates to estimate adjusted associations, with a formal interaction term if joint effects are the objective. Prospective designs would establish the temporal sequence and permit assessment of incident outcomes.

Conclusion

Among 142 selected hospitalized stroke records at RSUD dr. Doris Sylvanus in 2024, high recorded LDL was associated with greater unadjusted odds of an ischemic rather than

another stroke diagnosis (OR 2.90; 95% CI 1.26 to 6.67; $p = 0.010$). Hypertension and joint exposure estimates are provisional until conflicting source counts are verified. The findings describe associations within this hospital sample and do not establish incidence, causation, independent effects, or interaction.

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Conflict of Interest Statement

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