As previously observed in other phenylhydrazone derivatives (Tosi *et al.*, 1988; Chiba, Tani, Shuto, Haga & Tokonami, 1990), the bond distances in the chain show some shortening with respect to the expected theoretical values, probably depending on an extended π-electron conjugated system between the chain and the aromatic ring.

The phenyl ring is planar and forms a dihedral angle of 34.1° with the plane formed by N2, N1, C7. The rotation around the C1—N1 bond favours the release of steric hindrance between the H atoms of the phenyl and those of the C7 methyl group. The steric hindrance between the two methyls is probably also the cause of the opening of N2—C8—C9 with respect to the adjacent angles. Molecular packing is realized *via* van der Waals interactions.

The presence of some steric hindrance around the hydrazono skeleton may be responsible for the weak interactions, either in solution or in the solid state, with planar acceptors like tetracyanoethylene (Tosi *et al.*, 1988). As a matter of fact, as this acceptor is superimposed with the hydrazono skeleton rather than the phenyl rings (Tosi *et al.*, 1992), the molecular association is influenced by any steric interference on the donor. It is not surprising that the complex formed by the above compounds, but in the ratio $D/A = 1/2$, cannot be isolated due also to interference between the TCNE molecules. Stable crystalline complexes can be isolated only in the case of monohydrazones of diketones where the packing between the donor and the acceptor is reinforced by intermolecular hydrogen bonding between the carbonyl O atom and the H atom of the amino N of the hydrazone (Tosi *et al.*, 1992).

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Structure of Ticlopidine Hydrochloride – a Platelet Antiaggregating Agent

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(*Received* 9 *July* 1991; *accepted* 21 *October* 1991)

Abstract. 5-[(2-Chlorophenyl)methyl]-4,5,6,7-tetrahydrothieno[3,2-*c*]pyridine hydrochloride, $C_{14}H_{15}ClNS^+.Cl^-$, $M_r = 300.25$, triclinic, $P\bar{1}$, $a = 9.734$ (2), $b = 10.873$ (7), $c = 7.256$ (2) Å, $\alpha = 101.47$ (4), $\beta = 106.31$ (2), $\gamma = 81.60$ (4)°, $V = 719$ (1) Å^3, $Z = 2$, $D_m = 1.37$ (2), $D_x = 1.389$ Mg m^{-3}, λ(Mo $K\alpha$) = 0.71073 Å, $\mu = 0.57$ mm^{-1}, $F(000) = 312$, $T = 293$ K, $R = 0.044$ for 2520 observed reflections with $I > 3\sigma(I)$ and 163 parameters. The molecule consists of two quasi-planar fragments with a dihedral angle of 61.2 (8)°. The hydrochloride part is associated with the N atom. There is an intramolecular hydrogen bond H···Cl = 2.035 (1) Å with an N—HN···Cl angle of 172.3 (2)°. There are no intermolecular hydrogen bonds.

Introduction. In the last ten years much attention has been devoted to the potential interest of ticlo-

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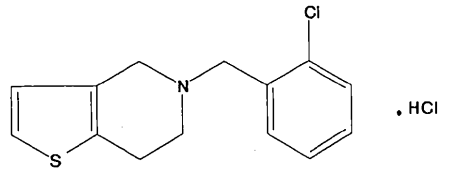
pidine.HCl in both the treatment and the prevention of thromboembolic pathologies. Investigations conducted with more ancient, and therefore better known, drugs such as *e.g.* acetyl salicylic acid (ASA), sulphinpyrazone and pyridamole have shown that the results obtained with ticlopidine.HCl (Panak, Maffrand, Picard-Fraire, Vallee, Blanchard & Roncucci, 1983) certainly classify it among the most interesting newer drugs proposed for the treatment of thromboembolic diseases. The structural formula of ticlopidine.HCl (see scheme) is different from that of either ASA, sulphinpyrazone or pyridamole. Though the results of pharmacological studies (Panak *et al.*, 1983; Saltiel & Ward, 1987; McTavish, Faulds & Goa, 1990) suggest that one or more active metabolites may play a part in the mechanism of action of ticlopidine.HCl, this mechanism is still poorly understood and appears to be different from that of the drugs just mentioned.



The present structure determination of ticlopidine.HCl was undertaken with the hope that a better knowledge of the structure of the molecule might help provide more insight into its mechanism of action by assisting in the interpretation of the ^{13}C solid-state NMR spectrum and thus fill the gap between solid-state and liquid-state NMR studies.

Experimental. Ticlopidine.HCl was crystallized as colourless blocks by slow evaporation of a mixture of ethanol and acetonitrile (1/1) at room temperature. D_m was measured by flotation in acetone/trichloroethylene. A selected single crystal 0.20 × 0.20 × 0.35 mm was used for data collection on an Enraf–Nonius CAD-4 automatic diffractometer using a graphite-monochromatized Mo $K\alpha$ radiation take-off angle of 3.5°. The compound crystallizes in the triclinic system. The cell dimensions were obtained from a least-squares fit to 25 reflections measured in the range $8 \le \theta \le 24°$; 2815 unique reflections were measured, the maximum Bragg angle θ_{max} was 26°, the scan mode being θ–2θ with $\Delta\theta = 0.90° + 0.35°\tan\theta$. The prescan speed was 10° min^{-1} for a final scan $\sigma(I)/I = 0.018$ and a maximum time of 80 s for the final scan. The standard reflections (054, 124, $\bar{2}0\bar{2}$) were monitored every 7200 s and no significant variation could be detected. The ranges of hkl were: $0 < h < 12$, $-13 < k < 13$, $-8 < l < 8$; 2970 reflections measured; 2815 unique; $R_{int} = 0.015$. Data were corrected for Lorentz and polarization effects; an absorption correction was found unnecessary. The structure was determined by direct methods; 2520 unique reflections with $I > 3\sigma(I)$, 163 refined parameters and full-matrix least squares (F) were used; the function minimized was $\sum w(\Delta F)^2$; the atomic scattering factors and the anomalous-dispersion corrections were taken from *International Tables for X-ray Crystallography* (1974, Vol. IV). The final indices were: $R = 0.044$, $wR = 0.048$, $w = 1$, $S = 0.7$; $(\Delta/\sigma)_{max} = 0.01$. The maximum height in the final difference synthesis was 0.4 e Å^{-3}. The calculations were performed with *SDP* (B. A. Frenz & Associates Inc., 1985) and the drawings with *ORTEP*II (Johnson, 1976) using a DEC VAX/11730 computer.

Table 1. *Positional and equivalent isotropic thermal parameters*

$B_{eq} = (4/3)\sum_i\sum_j \beta_{ij}\mathbf{a}_i.\mathbf{a}_j$.

	x	y	z	B_{eq} (Å^2)
Cl(1)	0.9748 (1)	0.30393 (7)	0.3605 (1)	6.25 (2)
Cl(2)	0.4462 (1)	0.1562 (1)	−0.1948 (2)	4.09 (3)
S	0.19272 (9)	0.47471 (8)	0.2070 (1)	4.11 (2)
N	0.5889 (2)	0.2099 (2)	0.2327 (3)	2.45 (4)
C(1)	0.3450 (3)	0.3700 (3)	0.2523 (4)	2.87 (6)
C(2)	0.4612 (3)	0.4209 (2)	0.2454 (4)	2.64 (5)
C(3)	0.4304 (4)	0.5471 (3)	0.2066 (4)	3.42 (6)
C(4)	0.2895 (4)	0.5872 (3)	0.1813 (5)	4.03 (7)
C(5)	0.3455 (3)	0.2380 (3)	0.2858 (5)	3.48 (7)
C(6)	0.4996 (3)	0.1811 (3)	0.3539 (4)	2.79 (6)
C(7)	0.6063 (3)	0.3486 (2)	0.2708 (4)	2.75 (6)
C(8)	0.7292 (3)	0.1277 (3)	0.2492 (4)	3.03 (6)
C(9)	0.8282 (3)	0.1395 (3)	0.4515 (4)	3.03 (6)
C(10)	0.9418 (3)	0.2151 (3)	0.5142 (5)	3.86 (7)
C(11)	1.0336 (4)	0.2206 (4)	0.7009 (6)	5.3 (1)
C(12)	1.0099 (4)	0.1509 (4)	0.8265 (6)	5.7 (1)
C(13)	0.8996 (4)	0.0743 (4)	0.7672 (4)	4.99 (9)
C(14)	0.8111 (4)	0.0678 (3)	0.5807 (5)	3.76 (7)

Table 2. *Bond lengths* (Å) *and bond angles* (°)

Cl(1)—C(10)	1.733 (4)	C(3)—C(4)	1.349 (5)
S—C(1)	1.727 (3)	C(5)—C(6)	1.520 (4)
S—C(4)	1.717 (4)	C(8)—C(9)	1.505 (4)
N—C(6)	1.498 (4)	C(9)—C(10)	1.393 (4)
N—C(7)	1.504 (3)	C(9)—C(14)	1.390 (5)
N—C(8)	1.507 (3)	C(10)—C(11)	1.393 (5)
C(1)—C(2)	1.348 (5)	C(11)—C(12)	1.379 (7)
C(1)—C(5)	1.502 (4)	C(12)—C(13)	1.375 (6)
C(2)—C(3)	1.429 (5)	C(13)—C(14)	1.380 (4)
C(2)—C(7)	1.494 (4)		

C(1)—S—C(4)	91.6 (2)	N—C(6)—C(5)	110.0 (2)
C(6)—N—C(7)	110.7 (3)	N—C(7)—C(2)	109.1 (2)
C(6)—N—C(8)	113.4 (2)	N—C(8)—C(9)	114.4 (2)
C(7)—N—C(8)	113.5 (2)	C(8)—C(9)—C(10)	123.1 (3)
S—C(1)—C(2)	110.9 (2)	C(8)—C(9)—C(14)	119.3 (3)
S—C(1)—C(5)	124.2 (2)	C(10)—C(9)—C(14)	117.6 (3)
C(2)—C(1)—C(5)	124.8 (2)	Cl(1)—C(10)—C(9)	120.9 (2)
C(1)—C(2)—C(3)	113.5 (3)	Cl(1)—C(10)—C(11)	117.9 (3)
C(1)—C(2)—C(7)	122.2 (3)	C(9)—C(10)—C(11)	121.3 (4)
C(3)—C(2)—C(7)	124.4 (3)	C(10)—C(11)—C(12)	119.1 (3)
C(2)—C(3)—C(4)	111.9 (3)	C(11)—C(12)—C(13)	120.7 (3)
S—C(4)—C(3)	112.1 (2)	C(12)—C(13)—C(14)	119.7 (5)
C(1)—C(5)—C(6)	109.7 (3)	C(9)—C(14)—C(13)	121.6 (3)

The fractional coordinates and the equivalent isotropic thermal parameters of the non-H atoms are listed in Table 1.* H atoms were located from the difference Fourier map, fixed at 0.97 Å from their associated attached atoms and assigned a 5.0 $Å^2$ isotropic temperature factor. The interatomic distances and bond angles are collected in Table 2.

Discussion. A ball-and-stick drawing of the molecule is shown in Fig. 1 (the H-atom numbering being omitted for the sake of clarity). The molecule contains three groups, which surround the N atom: the first includes the *a* and *b* rings [*i.e.* atoms S, C(1), C(2), C(3) and C(4), for the first, and C(1), C(2), C(5), C(6), C(7) and N, for the second]; the second corresponds to ring *c* [*i.e.* atoms C(9), C(10), C(11), C(12), C(13) and C(14)], associated with C(8) and Cl(1); while the third includes the HN···Cl(2) bond.

Ring *a* and atoms C(5) and C(7) lie in the same plane (the distances of the various atoms from this plane are less than 0.02 Å), while atoms C(6), N and C(8) stand apart from this plane by −0.27, 0.53 and 0.64 Å, respectively. Ring *b* is puckered and the part containing the three atoms C(5), C(6) and N forms an angle of 40.6 (3)° with the plane containing C(1), C(2), C(5), C(7) and N. Ring *c*, which is aromatic, is rigorously planar. The atoms C(8) and Cl(1) lie in this plane (distances less than 0.01 Å).

The phenomenon of conjugation is apparent in ring *a*, where the C(2)—C(3) bond [1.429 (5) Å] is situated between two shorter bonds: C(1)—C(2) [1.348 (5) Å] and C(3)—C(4) [1.349 (5) Å]. This phenomenon extends to the two other atoms, C(5) and C(7), since they lie in the same plane. It is also present in the phenyl ring, where homogeneous distances and bond angles are observed. A slight shortening of the C(8)—C(9) bond length can be mentioned.

The dihedral angle between rings *a* and *c* is 61.2 (8)°. The Cl(2) atom is closely associated with the molecule implying a strong hydrogen bond: HN···Cl(2) distance 2.035 (1) Å and N—HN···Cl(2) angle 172.3 (2)°. C(8) may be considered as the main ball-and-socket joint of the molecular architecture.

A perspective view of the contents of a unit cell is shown in Fig. 2. There are no other intramolecular hydrogen bonds apart from the NH···Cl(2) bond just described, neither is there any intermolecular hydrogen bond as the distance between two molecules is greater than 4.0 Å. The bond lengths and angles are similar to those found in an analogous compound ($C_{26}H_{32}NO_6S_2Cl$) (Enjalbert, Galy, Géhénot, Rao, Maire & Fréhel, 1989), which also exhibits very interesting antiaggregating properties.

* Lists of structure factors, anisotropic thermal parameters and H-atom parameters have been deposited with the British Library Document Supply Centre as Supplementary Publication No. SUP 54794 (30 pp.). Copies may be obtained through The Technical Editor, International Union of Crystallography, 5 Abbey Square, Chester CH1 2HU, England. [CIF reference: PA0247]

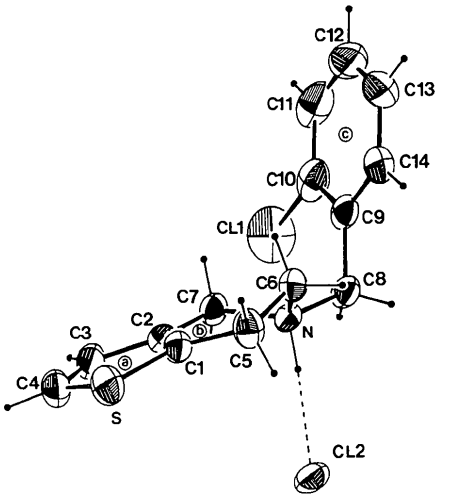


Fig. 1. Ball-and-stick drawing of ticlopidine.HCl.

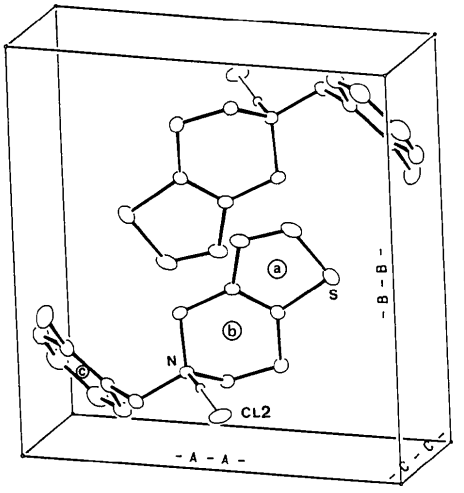


Fig. 2. Perspective view of the contents of a unit cell of ticlopidine.HCl.

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